सत्यमेव जयते

INDIAN AGRICULTURAL

RESEARCH INSTITUTE, NEW DELHI

I.A.R.I. 6

GIPNLK—4/JDIARI/60—16-3-61—5,000

INTERNATIONAL REVIEW

OF THE

SCIENCE AND PRACTICE

OF

AGRICULTURE

PUBLISHED BY THE INTERNATIONAL INSTITUTE OF AGRICULTURE

New Series

Vol. III. – No. 3. – July-September 1925

319100

IARI

ROME

PRINTING OFFICE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

1925

In quoting articles, please mention:
International Review of the Science and Practice of Agriculture,
International Institute of Agriculture.

CONTENTS

ORIGINAL ARTICLES.

Page

KUCHARENKO, J. A. The Propagation of Crystals in a Supersaturated Solution 651
STOKLASA, J. Aluminium in Organic Life 655
CHEVALIER, A. A Bio-Geographical Classification of the Principal Cropping Systems of the World 663
CHIRITESCU-ARVA, M. The Cultivation of Leguminous Seed Crops in Roumania 680
BORDIGA, O. State Irrigation, and Agriculture in the South of Italy 694

INTERNATIONAL ASSOCIATIONS.

Proceedings of the International Society of Soil Science.

Papers.

HISSINK, D. J. Methods of mechanical analysis of soils. 705
AVATTANEO, R. The degree of solubility of phosphate and potash fertilisers necessary to maintain the soil solution at the concentration required by plants 725

Abstracts and Literature.

General: Animal Life in Deserts, *p.* 728. — Geology, *p.* 729. — Soil Morphology and Agricultural Science, *p.* 729. — Peat and its Applications, *p.* 729. Properties of the Soil and their Improvement as a Basis for a general Farming Scheme, *p.* 730. — Short Manual of Soil Science for the Use of Surveyors and Agricultural Technicians, *p.* 730. — Experiments with Subsoiling, Deep Tilling and Subsoil Dynamiting, *p.* 731.

Soil Physics : The Temperature of the Surface of Deserts, *p.* 731. — Note on Capillary Rise in Soils, *p.* 732. — New Apparatus for Determination of Soil Permeability, *p.* 733.

Soil Chemistry : Research on the Formation and Decomposition of Humus in the Soil, *p.* 733. — Chemical Decomposition in the Egyptian Deserts, *p.* 733. — A Chemical Examination of Sand from the Mediterranean Coast of Palestine, *p.* 736. — The Effect of Iodine on Soils and Plants, *p.* 736. — Soil Acidity and its Relation to the Production of Nitrate and Ammonia in Woodland Soil, *p.* 736. — The Necessity for Improvement in the Chemical Analysis of Agricultural Soils, *p.* 737. — Biochemical Studies on the Acidity of Forest Soils, *p.* 738. — Application and Significance of Electrometric Titration for the Determination of the Reaction of Soils, *p.* 739. — Electrometric Filtration and the Use of Quinhydrone, *p.* 739. — Studies on Base Exchange in Rothamsted Soils, *p.* 740. — Base Exchange in Relation to the Problem of Soil Acidity, *p.* 740. — The Relation between the P_H Value, the Lime Requirement, and the Thiocyanate Colour of Soils, *p.* 741. — Cause and Nature of the Transformation of Lime in the Soil, *p.* 741. — Quantity and Nature of the " Black Substance " in certain Moravian Soils, *p.* 742.

Soil Biology : Soil Analysis by Means of Bacteria, *p.* 742. — Partial Sterilisation of Soil by Antiseptics, *p.* 743. — Preliminary Investigations on the Relationship of Protozoa to Soil Fertility with Special Reference to Nitrogen Fixation, *p.* 743. — Protozoa from the Soils and Mosses of Spitzbergen, *p.* 743.

Soil and Vegetation : The Forestry Value of the Sands of the Dunes and of Sandy Soils in General, *p.* 744. — The Influence of the Amount of Nutritive Substances and of the Soil Acidity on the Growth of Trees in the Flottlehmgebieten of Syke in North-West Germany, *p.* 744. — Effect of Soil Alkali on Plant Growth, *p.* 745. — The Cultivation of Corn, Weed Control and Moisture Conservation, *p.* 746.

Regional Soil Science : Nature of the Rocks and Soil of the Upper Layers of Soil in the Kursk District (Russia), *p.* 746. — The Soil of Russia and the Surrounding Regions, *p.* 749. — An Agronomical and Scientific Examination of the Soil in the Welwarn District, *p.* 750. — Chalk in Lettonia, *p.* 750. — Agricultural Conditions in Palestine, *p.* 751. — The Soils in the Drina, Save and Morava Areas, *p.* 751. — The Soils of Lettonia, *p.* 752. — Alkali Soils in Iraq, a Preliminary Investigation, *p.* 753.— Further Studies on Alkali in Iraq, *p.* 753. — Bibliography, *p.* 755.

General Information.

International Society of Soil Science, *p.* 759. — The International Commissions, *p.* 760. — Notice of May 1925, *p.* 760. — II International Commission for the Study of Soil Chemistry, *p.* 761. — Report of a Meeting of the Supervisory Committee for the International Soil Map of Europe, held on 8 and 9 May 1925, in Berlin, *p.* 762. — Journal Pédologie, *p.* 762. — Personal, *p.* 762.

SPECIAL ACTIVITIES OF THE BUREAU OF AGRICULTURAL SCIENCE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE.

International Commission of Agricultural Ecology.

International Institute of Agricultural Ecology, *p.* 766.

Enquiry on Dairy Cow Testing.

The Development of the Dairy Industry in India, *p.* 781.

Enquiry on Locust Control.

Locusts in Cirenaica, *p.* 787.
Locusts in Tripoli, *p.* 788.

Enquiry on the Prevention of Anthrax Infection of Herds.

Report, *p.* 788.

Enquiry on the Stock Breeding Services and Higher Instruction in Stock Breeding.

The first results, *p.* 788.

Enquiry on the Results Obtained by Farm Accountancy.

New Enquiry, *p.* 789.

AGRICULTURAL INTELLIGENCE.

Agronomy.

Soil Science. — See *R.* Part II, Proceeding of the International Society of Soil Science, Abstracts.

Fertilisers and Manures. — 556. Fertiliser Tests with and without Ground Limestone. — 557. Nitrifying Bed for Prevention of Nitrogen Losses from Cattle Urine. — 558. Manurial Value of Sugar By-Products. — 559. Basic Slags and Mineral Phosphates. — 560. Recovery of Potash from Steffan Waste Water. — 561. World's Situation as regard the Nitrogen Problem. — 562. The Action of Manganese Sulphate in the Mineralisation of Nitrogen.

Agricultural Botany, Chemistry and Physiology of Plants. — 563. Investigations on the Environmental Conditions which Influence Plant Life, made in the Laboratory and Experimental Ground of Prof. DOJHARENKO at the Moscow Agricultural Academy. — 564. Plant Production as a Measure of Environment. — 565. Factors Affecting Yield in Tropical Crops. — 566. Influence of the Duration of Light on Growth. — 567. Acidity Changes during the Growth Period of Wheat with Reference to Stem-Rust Resistance. — 568. The Irritant Action of Various Chemical Products and its Effect on the Germination of Potato Tubers. — 569. Effect of Nitrate Application upon the Hydrocyanic-Acid Content of Sorghum. — 570. Substances Similar to Insulin Extracted from Plants. — 571. Absorption of Urea by Fungi. — 572. The Function of Nicotine in the Tobacco Plant. — 573. The Presence of Substances similar to Insulin in Beans.

Plant Breeding and Seeds. — 574. A Programme of Maize Improvement. — 575. Comparative Tests of Six Philippine Maize Varieties. — 576. Machine Winnowing of Paddy Seed. — 577. The Effect of Dry Heat on Alfalfa Seed and its Adulterants.

Crops in Temperate and Tropical Countries.

(Including Forestry).

Cereals, Roots and Forage Crops. — 578. The Manuring of Grass Land for Hay at Rothamsted. — 579. Silani, a new Cover and Forage Crop.

Fibre Plants. — 580. Rain Grown Cotton and Climate. — 581. Cotton-Growing in Eritrea. — 582. The Quality of Ratooned Queensland Cotton. — 583. Possibility of Creating a Flax Industry in South Africa. — 584. Sisal Hemp. — 585. Henequen Fibre or Mexican Sisal Hemp.

Tropical and Sub-Tropical Industrial Plants. — 586. Continuous Growth of Java Indigo in Pusa Soil. — 587. Studies in Jelutong. — 588. A Comparison of the Yields of Beets in Czecho-Slovakia. — 589. Tea Nurseries. — 590. Cultivation of the Tea Plant at Tranninh (Haut-Laos). — 591. The Chemical Analysis of Tea with regard to Quality. — 592. Nicotine and Ash Constituents of the Leaf of Tobacco Plants. — 593. Essential Oils from various Parts of the British Empire.

Arboriculture. — 594. Orchard Practices in the Citrus Industry of Southern California. — 595. The Banana and its Cultivation. — 596. Almond Varieties in the United States. — 597. Walnut Culture in California.

Forestry. — 598. Forestry and Agriculture. — 599. Regeneration of Forest Species with the Assistance of "Taungya" in Burma. — 600. Reafforestation with Cedar (*Juniperus Procera*) of the Shume Forest Reserve, Tanganyika Territory. — 601. The Growing of Poles for Electric Transmission. — 602. Coolibah Timber of Western Australia. — 603. Balsa Wood from British Honduras. — 604. Burma Oak and Chestnut Tans.

Live Stock and Stock Breeding.

General. — 605. Additional Information on the Relations between Internal Secretary Glands and Immunity. — 606. The Elastic Mucous Tissue of

the Cock's Comb and its Reaction on the Sexual Hormone. — 607. Vine Shoots as a Cattle Feed.

Special. — 608. Classification of European Breeds of Cattle. — 609. Feeding Calves on Milk, Supplementary Feeds and Milk Substitute. — 610. Milk Testing of the Salers Breed. — 611. Pig Breeding in Tunis.

Poultry. — 612. The Evolution of Potentialities in Chickens. — 613. Growth of Single-Comb White Leghorn Chickens.

Farm Engineering.

Irrigation. — 614. The Relation between Water Supply and Plant Growth on Irrigated Land. — 615. A Short History of Irrigation in South Africa.

Methods of Cultivation. — 616. Cultivation of Wheat in Austria by the Spaced-Row and Hoeing System. — 617. Mechanical Tillage on Sugar Plantations. — 618. Trials of Sub-Soiling 1924. — 619. Experiments with Fallow in North-Central Montana. — 620. Spacing Experiments, a New Method.

Machines and Implements. — 621. Recent Innovations in Farm Machinery. — 622. Recent Developments in Oil Palm Machinery.

Rural Economics.

623. The Importance of the Cultivation of Roots on the Organisation of Farming. — 624. A Study of Farm Organization in Central Kansas. — 625. Agricultural Valuations. — 626. The Profit Yielding Capacity of Farms with Regard to Recent Valuation for Income Tax of Agricultural Properties, Large, Average Sized and Small. — 627. The Cost of Production of Sugar Beet in Hungary. — 628. Transport in Tropical Africa.

Agricultural Industries.

Plant Products. — 629. Cold Concentration of Vegetable Solutions and new Applications of Refrigerator Plant in Wine- making. — 630. Dried Beet Slices and Beet Flour. — 631. The Physiology of Apples as related to Storage. — 632. Problems of Apple Transport Overseas. — 633. Marketing and Distribution of American-Grown Bermuda Onions. — 634. The Vitamine Content of Fungi. — 635. British Guiana Woods for Paper Making. — 636. Investigations of Paper Making Materials. — 637. The Diagnosis of Decay in Wood.

Animal Products. — 638. The Gerber Method for Determination of Fat in Milk. — 639. Additional Information on the Influence of Foot-and-Mouth Disease on Milk and especially on Fat Production. — 640. The Contamination of Water used in the Milk Industry and its Sterilisation by Ozone. — 641. Influence of Pasteurisation on the Digestibility of the Albuminoid and Mineral Constituents of Milk.

Plant Diseases and Pests.

Plant Parasites. — 642. Dust Treatment for Control of Oat Smut (*Ustilago Avenae* and *U. Laevis*). — 643. *Bacillus phytophthorus*, the Cause of " Potato Blackleg ", disseminated by the Dipteron *Phorbia fuscipennis* in Minnesota. — 644. *Bacterium Salicis* n. sp. Injurious to *Salix caerulea* in England. — 645. *Macrophoma Corchori*, a Deuteromycete injurious to the Jute Plant, *Corchorus capsularis*, in India. — 646. *Phytophthora omnivora* var. *Arecae*, Peronospora injurious to the Coconut Palm in Malabar. — 647. Diseases of the Coffee Plant in the State of San Paulo (Brazil).

Animal Parasites. — 648. Orthoptera in Bengasi. — 649. British Coccidae.

CURRENT NOTICES.

Legislative and Administrative Measures. — 650. The Fruit Wines of Costa Rica. — 651. Control and Protection of Forests in Spain. — 652. Spain: The Cutting of Trees on Private Property. — 653. Spain: Regulations concerning Wines and Alcohol. — 654. France. Repression and Fraud in the Fertiliser Industry. — 655. France: Regulation of the Trade in Cereal Seeds. — 656. Colonisation in Algeria. — 657. Morocco: Decree for the Agricultural and Silk Industries. — 658. Martinique: The Encouragement of various Plantations in Martinique. — 659. Measures for Protection of Plants against Parasitic Diseases in French Oceania. — 660. Italian Laws and Decrees respecting Land Improvement and the Granting of Agricultural Credits. — 661. Measures for the Control of Plant Diseases in Italian Somaliland. — 662. Holland: Ministerial Regulations for the Control and Marking of Cheese. — 663. Paraguay: Cotton Seed in Paraguay. — 664. Roumania: New Regulation for Wheat, Flour and Bread. — 665. Venezuela: Protection of Forests and Water Reserves of Venezuela.

Experiment Stations and Agricultural Institutiom. — 666. Germany: A German Research Laboratory for Chemical Fertilizers. — 667. Germany: A Hydrological Research Station. — 668. Phenological Maps published by the German Phenological Service. — 669. Germany: The " Karl-Heinz-Thost Foundation ". — 670. Brazil: Programme of the Experimental Station for Cocao in Brazil. — 671. Spain: The Agricultural Fields (" Campos agrícolas ") attached to the National Schools in Spain. — 672. United States: Experiments on Growing of Sugar-beet in Louisiana U. S. A. — 673. Nebraska (U. S. A.) Experiments in Cereal Growing. — 674. New courses of Rural Science at the " Virginia Polytechnic Institute ". — 675. International Seed Exchange. — 676. United States: Annual Report of the American Research Laboratory for Fixed Nitrogen. — 677. American Foundation for the Study of the Chemistry of Wood and its Derivatives. — 678. Cuba: Note on " Mosaic " of Sugarcane. — 679. France : A

Technical School for the Study of Petroleum. — 680. Morocco: Native School of Agriculture. — 681. Professional School of Agriculture in Porto-Novo (Dahomey). — 682. Great Britain: Agricultural Research in France and Great Britain. — 683. Great Britain: Experiments on Broccoli Growing. — 684. Australia: A National Museum for the Study of Australian Fauna. — 685. Trinidad: Instructional and Experimental Sugar Factory of the Imperial College of Tropical Agriculture. — 686. A New Zealand Demonstration Farm. — 687. An Australian Agricultural Research Institute. — 688. Italy: Production of Pure Seed in Italy. — 689. Italy: Italian Scholarships for Farm Engineers. — 690. Italy: Competition in Agriculture. — 691. Italy: Foundation for Study of Feeding of Dairy Cows. — 692. Italy: Prize Competition. Organic Chemistry as applied to Agriculture. — 693. Italian Scholarships for the Improvement of Studies relating to Fish.

Associations and Agricultural and Scientific Institutions. — 694. International Federation of Aviculture. — 695. Austria: The Viennese Agriculture and Forestry Club. — 696. Columbia: the XXth Anniversary of the Agricultural Association of Columbia. — 697. Ecuador: Agricultural and Stock-Breeding Services. — 698. United States: The Development of the Federal Crop Reporting Service. — 699. United States: American Association for the Advancement of Science. — 700. Cuba: National Association of Horticulture in Cuba, — 701. France: A National Bureau of Combustible Liquids. — 702. France: Reports on the Works of the " Comité Central de Culture Mécanique ". — 703. The Isle of Réunion Water and Forestry Service. — 704. Annam Veterinary Service. — 705. Report of the Department of Agriculture of the Union of South Africa. — 706. Italy: Associations for Soil Improvement in Southern Italy and the Insular Possessions. — 707. Italy: The " Federation Pro-Montibus " and its Work. — 708. Proceedings of the " Società Agronomica Italiana ". — 709. The Drought Commission of the Union of South Africa. — 710. Western Australian Forestry's Report. — 711. XII International Congress of Agriculture, Warsaw, 21-24 June, 1925. — 712. Argentine: International Congress of Social Economy. — 713. France: International Timber Congress at Lyons, September 1925. — 714. Italy: International Road Congress at Milan, September, 1926. — 715. Portugal: Science Congress at Coimbra, June, 1925. — 716. France: Congress on the Colonial Customs, Marseilles, June 1925. — 717. France: Congress at Grenoble of the " Association Française pour l'Avancement des Sciences ". — 718. Algeria: Congress of Wheat Growers of Northern Africa, Algiers, 12 to 14 January, 1925. — 719. Italy: XIXth National Congress of Travelling Professorships of Agriculture, Rome, April, 1924. — 720. First National Forestry Congress, Rome, May, 1925. — 721. Conference on Agricultural Research, Rome, April, 1925. — 722. Congress in Celebration of the 25th Anniversary of the Travelling Professorship of Agriculture in the Province of Syracuse; Syracuse, 5-7 April 1925. — 723. Italian Wine Day at Milan, April 24, 1925. — 724. Italian Winemakers Day, Milan, 22 April, 1925. — 725. Italian Wine Conference. Milan, 20-27 April 1925. — 726. XIVth Meeting of the Italian Association for the Progress of Science,

Pavia, 24-28 May, 1925. — 727. Mexico: First Congress of Stock Breeding and Veterinary Hygiene, Mexico, 8-28 November 1924.

Exhibitions, Fairs, Competitions. — 728. Germany: International Fair at Frankfort; Spring Meeting 1925. General Fair from April 19-25; Technical Fair from April 12-22, 1925. — 729. Argentina: IVth International Live Stock Show at Palermo, Argentina, September, 1924. — Switzerland: International Fair of Colonial and Exotic Products, Lausanne, from 27 June to 12 July 1925. — 731. Germany: Sugar-Exhibition, Magdeburg, 23 May to 7 June, 1925. — 732. Argentina: Cotton Congress, Corrientes, September, 1924. — 733. IIIrd, Agricultural Exhibition; Competition for Dairy Cows; Exhibition of Pure Seeds; Argentina, 18 to 26 April 1925. — 734. United States: A Rubber and Tropical Products Exhibition. — 735. United States: National Exhibition of Chemical Industries, New York from 28 September to 3 October, 1925. — 736. Cuba: Stock Breeding Exhibition, Havana, 1926. — 737. Poultry Exhibition, Havana, Cuba, February, 1925. — 738. Tunisia: General Exhibition of Horticulture and Forestry, Tunis, April 1925. — 739. France: General Competition of Autocars and Gas-generators, France, 15 September, 1925. — 740. Italy: Competition for the Smaller Agricultural Industries and Manufactures of Italy. — 741. Uruguay: Exhibition of Agricultural Products. Montevideo, 19 June 1924.

Development of Agriculture in Various Countries. — 742. Germany: The Situation of German Agriculture at the beginning of 1924. — 743. Brazil: Official Data on Brazilian Agriculture. — 744. United States: The National Forest Reserve of New-Hampshire, U. S. A. — 745. Sudan: The Development of Cotton-Growing in Anglo-Egyptian Sudan. — 746. East Africa: Tea Enterprise in Kenya Colony. — 747. Australian Irrigation Scheme. — 748. Italy: Improvement of Grasslands and Pastures of Mountain Communities in Italy. — 749. Russia: Agricultural Progress in Russia. — 750. Czecho-Slovakia: Note on Czecho-Slovakian Agriculture.

Miscellaneous. — 751. The Worlds Rubber Position. — 752. The Anti-opium Activities of the League of Nations. — 753. New Process for Removal of Acidity from Oils and Fats. — 754. A German Agricultural Delegation in the United States of America. — 755. Brazilian Oil Palms. — 756. Brazil: Report on the Progress of Agriculture in Brazil. — 757. Meat and Coffee and their Relation to the Export-Trade of Brazil. — 758. Hygienic Organization in Brazil. — 759. Brazilian Inquiries on the Increase of Prices. — 760. The Metric System adopted by Canada. — 761. The British Sugar Beet Industry. — 762. An Improved Method of Transplanting Young Trees. — 763. Land Reclamation in Italy. — 764. Internal Colonization in Italy. — 765. Holland: Tea Planting in the Dutch Indies during a Century (1824-1924). — 766. Roumania: Monograph on Agricultural Costing. — 767. France: Cyanamide Production in France. — 768. Morocco: The Sale of Moroccan Phosphate in 1924. — 769. France: Protection of Antartic Fauna. — 770. Portugal: The Discovery of the Alkaloids in Quinine. — 771. Nitrogen Fixation in Czechoslovakia.

Journals and Reviews. — 772. The " Illustrierte Landwirtschaftliche Zeitung " — 773. The " Deutsche Bergwerks-Zeitung. — 774. The " Kolloid Zeit-

schrift ". — 775. La " Colmena ". — 776. The " Boletín de Agricultura técnica y económica ". — 773. " El Progreso Agrícola y Pecuario ". " La Vida Agrícola ". — 779. The Missouri Year Book of Agriculture for 1924. — 780. The new Journal of the Agricultural Education Association of Great Britain. — 781. Yearbook of the Italian Agricultural Press. — 782. A Pamphlet on Peruvian Guano.

Personal. — 783. Th. NELSON ANNANDALE. — 784 BERTRAND. — 785. R. BIEDERMANN. — 786. A. van BIJLERT. — 787. A. BORZÌ. — 788. B. BRUCKNER. — 789. N. H. COWDRY. — 790. A. DENDY. — 791. G. FRON. — 792. W. A. HASWELL. — 793. F. HÉRELLE. — 794. H. KARLIK. — 795. W. von KNIERIEM. — 796. W. KOERNER. — 797. H. SPENCER JENNINGS. — 798. A. LENTICCHIA. — 799. F. R. LILLIE. — 800. A. F. MOLLER. — 801. V. C. BOYS and PERKIN. — K. PRZIBYLLA. — 803. P. ROSCHER. — 804. E. J. RUSSELL. — 805. O. R. SCHRAMM. — 806. R. ZSIGMONDY.

NOTE. — The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in this *Review*.

The Editors notes are marked (*Ed.*); the letter *R.* indicates the references to the foregoing issues (Monthly and Quarterly) of the International Review.

ORIGINAL ARTICLES

THE PROPAGATION OF CRYSTALS IN A SUPER-SATURATED SOLUTION (1).

In a previous article (New Theory of Solutions) were stated what I consider to be the laws relative to the process of crystallisation and dissolution, based on the results of my experimental work in this province. A promise was made to treat at an early date in a more detailed manner a series of questions which were only touched upon in that article, and to give further explanations, after having placed in order the materials which had obtained from the experiments.

The present article is the first of this supplementary series and deals with the question of the propagation of the process of crystallisation in a supersaturated solution.

In the previous article it was stated that the general crystallisation of a supersaturated solution seems to be the result of the division of a pre-existing crystal. How should this be interpreted? According to my conception of the process of crystallisation, a decrystallised and supersaturated solution can scarcely crystallise spontaneously. To make it crystallise, at least one single crystallon of the supersaturated matter must be introduced.

Logically, the application of this principle raises another question, which may be formulated as follows: Suppose we have, in an enclosed space, a certain quantity of decrystallised and supersaturated solution. By some means a single crystal has been introduced into it. The solution crystallises. How is this total crystallisation

(1) See Prof. J. A. KUCHARENKO, New Theory of Solutions. *R.* Vol. III, No. 1, 1925.

brought about? Is it the result of a molecular and so to speak catalytic influence through the presence of the crystal, or is it caused by the ultramicroscopic particles (the crystallons) which detach themselves from the crystal introduced and which become so many centres for all the crystals in process of formation? In order to examine this question the following series of tests were made. Solutions of potash-alum were prepared in round glass bowls (crystallisers) with their edges turned down vertically, the solutions being supersaturated and decrystallised. This substance was chosen on account of its comparatively rapid crystallisation. In order to completely isolate the crystallisers they were covered with stout and compact Swedish filter paper, and tied with string. This precaution was sufficient to prevent the solutions, prepared at a high degree of supersaturation, from crystallising in a laboratory artificially impregnated by myriads of microscopically small crystals.

The crystalliser being thus protected and containing a supersaturated and decrystallised solution of alum, and the protective paper cover being taken off in a laboratory previously impregnated with 0.5 gm. of crystal alum, ground to a fine powder, a few minutes suffice to cause the total crystallisation of the solution. The microscopic particles of alum, transformed into powder, are distributed very uniformly in the atmosphere; from this it may be supposed that the whole surface of the crystalliser will become covered with perfectly equally distributed crystals.

This supposition was confirmed by the result. Fig. 106 (Table LI) represents a photograph taken from above. By the side of the crystalliser is a reduced scale (in centimetres) giving the natural size of the bowl, the crystals and their distribution over a unit of surface.

If the conditions of contact (infection) be then changed by causing crystallisation by means of a single crystal placed in the centre of the crystalliser, the process of crystallisation proceeds quite differently, as shown in Figs. 107, 108, 109. If the crystal placed in the centre of the crystalliser, filled with a supersaturated and decrystallised solution, acted as a catalyser of crystallisation, it would cause a general crystallisation not differing from that shown in fig. 106.

How then does a crystal act which is introduced into a supersaturated and decrystallised solution, and how is the process of crystallisation propagated in the second case, *i. e.* where contagion comes from a central crystal? Numerous experiments were made with solutions of different degrees of supersaturation, and in a great number

PLATE LI.

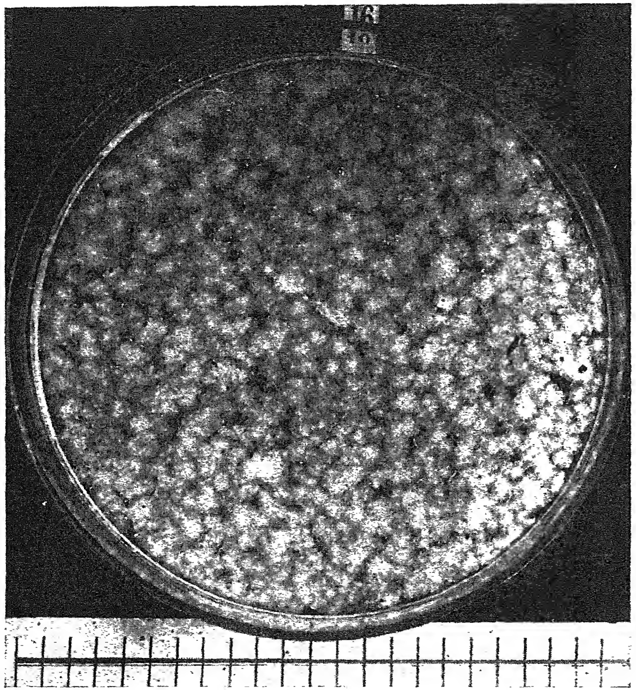


FIG. 106. — A decrystallised solution of alum, containing 40.0 % of $K_2SO_4Al_2(SO_4)_3\ 24H_2O$. After having impregnated the atmosphere of the laboratory with powdered alum crystals, the crystalliser was opened for 10 minutes. When the crystallisation was finished, the crystalliser was photographed. The even distribution of the crystals over the whole surface of the crystalliser will be observed.

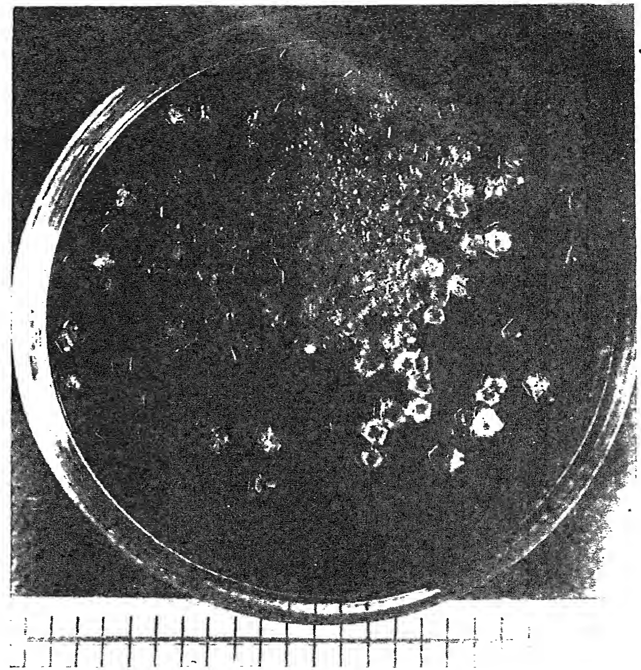


FIG. 107. — A decrystallised solution of alum, containing 20.1 % $K_2SO_4Al_2(SO_4)_3\ 24H_2O$. Crystallisation is induced by placing a crystal in the centre of the crystalliser. The photograph was taken on the termination of the process of crystallisation. It will be seen that the number of crystals decreases as the distance increases from the centre of contagion.

PLATE LII.

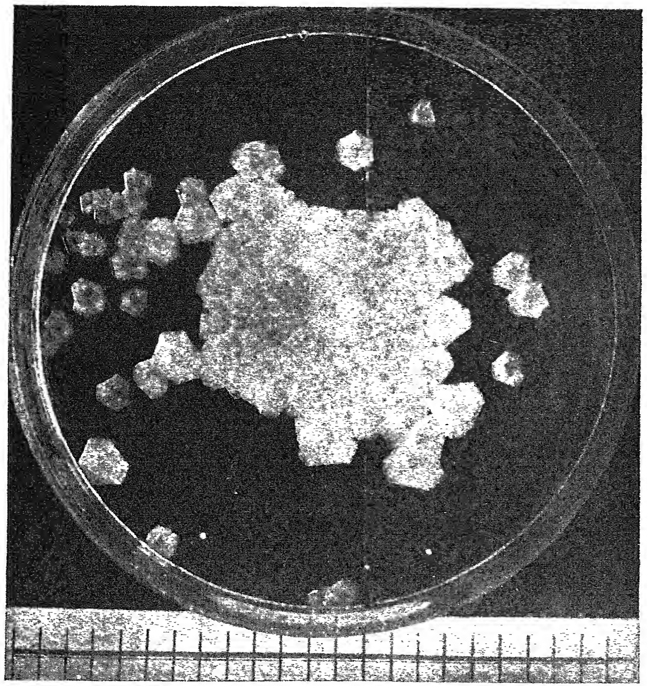


FIG. 108. — A decrystallised solution of alum, containing 29.8 % of $K_2SO_4Al_2(SO_4)_3$ $24H_2O$. Crystallisation is brought about by placing a crystal in the centre of the crystalliser. The photograph was taken on the termination of the process of crystallisation. Owing to the considerable super-saturation, the crystals at the centre have united on increasing, without however losing their individual contours. In the periphery the crystals increase in size; separately owing to the greater distance which separates them one from another.

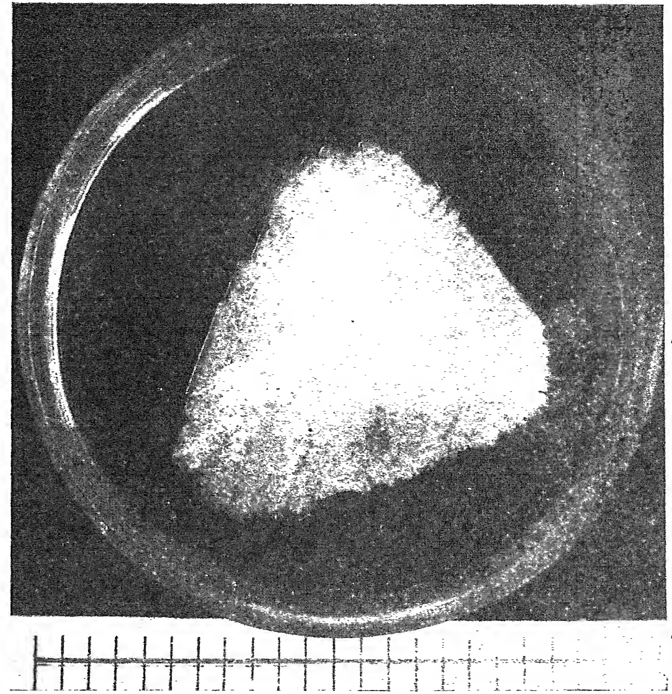


FIG. 109. — A decrystallised solution of alum, containing 45.4 % of $K_2SO_4Al_2(SO_4)_3$ $24H_2O$. Crystallisation is brought about by placing a crystal in the centre of the crystalliser. The protograph was taken on the termination of the process of crystallisation. The union of the crystals is further increased by a greater super-saturation, as a result of which the crystals in the centre have lost their individual contours.

of cases photographs were taken. The results justified us in affirming in the previous article (New Theory of Solutions) the hypothesis laid down as to the mechanism of the process of crystallisation, and which will be developed on the following lines:

A crystal, introduced into a supersaturated solution, begins to accumulate on itself the matter it draws from the layer of solution with which it is in direct contact. The concentration of this layer consequently decreases and currents of concentration are formed which mechanically carry along with them ultra-microscopic particles of crystals (crystallons). The latter disperse more and more around the central crystal, forming additional centres of crystallisation.

If the supersaturation is not considerable (fig. 107, 10.1 %) the process of crystallisation terminates before the crystals succeed in rejoining one another while increasing. If, on the contrary, the supersaturation is considerable, the separate crystals unite into a single one (fig. 4, 45.4 %). Fig. 3, with medium super-saturation (29.8 %) represents an intermediary stage between those of figs. 2 and 4: in the centre the crystals have united in their growth, without, nevertheless, having lost their contours; in the periphery the crystals remain separated.

On examining figs. 107, 108, 109, it will be observed that as the distance increases from the central crystal, the crystals formed diminish in number progressively. The decrease in the number of crystals detached and the degree of their dispersion becomes greater with the weakening of the intensity of the currents of concentration. The causes which bring about this weakening are, for instance, the influence of a substance of which the speed of crystallisation is insignificant, or that of an increase of viscosity, or again of the decrease of the layer of solution.

This deduction explains the phenomenon observed, that, by taking some precautions against outside contagion, at a low temperature separate crystals of saccharose can be increased in a solution of saccharose considerably supersaturated and viscous, without causing a general crystallisation of the whole solution. Evidently the currents of concentration set up in this case are so weak, that they are not sufficient to detach the crystallons from the crystal and disperse them in the solution.

Thus then, the examination of the propagation of crystals in a superaturated solution lead to the conclusion that, a total crystallisation of supersaturated solutions is caused by the division of a pre-

existing crystal, in the absence of which crystallisation is impossible. The influence of the currents of concentration of the crystal and the rubbing of the crystals one against another may be indicated as the causes of the particles detaching themselves from the pre-existing crystal and afterwards forming centres for the total crystallisation.

Whether they are the only causes which determine crystallisation, or whether there are others which have not been taken into account, is a question which remains still to be examined.

The investigations are being continued, and an account of them will be published as soon as definite results are obtained.

Prof. J. A. KUCHARENKO,
Director of the Institute of Scientific Research on the Technology of Agricultural Industries, Kieff, (Ukraine).

ALUMINIUM IN ORGANIC LIFE.

After oxygen and silica, aluminium is the most widely disseminated element on our planet and forms one of the chief constituent parts of the earth's solid crust. It is maintained that aluminium is not absorbed by plants, and if present in the organism only forms an accessory constituent part of the cells and is of no importance as regards the structure and plant metabolism.

Mention may be made here that many tests have been carried out by various investigators on certain crops, without the factors under which plants in a natural state develop having been taken into consideration. My investigations and those of my collaborators have shown that an important role and physiological function are to be attributed to aluminium in certain families of plants (1).

We observed that all plant organs of the xerophytes, *i. e.* plants which prefer dry surroundings, which live on the sandy sea-shore, in the steppes, prairies and desert, and are provided with protective apparatus against desiccation, are disinguished by a low aluminium content. The hygrophytes, on the contrary, which prefer or grow in water, are notable for a high aluminium content. Cryptogams especially, for instance, algae, show a marked aluminium content in their dry matter.

From the whole plant-life economy of the hygrophytes it is perceived that the absorption of aluminium from the water or soil is a special need. Among them there predominates a particular preference for aluminium, which concentrates in the roots, rhizomes, tubers and bulbs of the more highly organised plants. The aerial part of these plants always contains less aluminium than the subterranean parts. Aluminium is also stored up in the reserve matter of

(1) A detailed work by JULIUS STOKLASA on the dissemination of aluminium in nature and its importance to the structure of plants and to plant metabolism has been published by Gustav Fischer, Jena. This work has aroused keen attention throughout the scientific world. (*Ed.*).

their seed. The salt-plant family (halophytes) also show large quantities of aluminium in the root system.

In the case of the mesophytes, the plants which prefer air and soil of medium moisture, it was found that in those which developed in dry places, both the roots and aerial part were exceedingly low in aluminium. But those plants which had grown up on a wet marshy soil had, especially in the roots, stored up large quantities of aluminium.

From all the observations made it was concluded that in plants which more or less prefer moisture, a specific porosity of the cells of the radical system exists, also that special reactions of the plasma colloids take place, as well as chemical processes of the plasma constituent parts of aluminium.

There are great quantities of iron compounds in the soil, and accumulation of iron in the cells of the radical system causes plasmolysis (cell destruction) and the gradual dying-off of the plant. When aluminium compounds are present, however, plasmolysis does not take place; the aluminium combines with various bodies in the cell sap and hinders the entrance of iron and manganese compounds into the cells. We look upon this phenomenon as a very important physiological factor of aluminium in the structure and in the metabolism of plants, consequently this element forms an indispensable constituent part of those plants which prefer water and which do not thrive in a soil rich in iron.

If the plant is in a nutrient medium rich in iron and which therefore contains more iron than the plant needs for its development, the accumulation of the excess of iron causes disturbance in the cells because the plant finds no use for large quantities of iron in its first period of growth. But when aluminium is present, it hinders the entrance of the iron into the radical system and thereby protects the plant.

Aluminium also possesses the interesting property of participating in the *formation of the colouring matter* of the flowers. Our investigations led to the discovery of the fact that aluminium, with iron and manganese, has a great influence on the colouring matter dissolved in the cell sap. These three elements not only increase the intensity of the colouring but also cause *changes in the latter*, white and pink flowers becoming red, and possibly violet or blue, and yellow ones changing to red.

In the animal world also an important part as regards colouring is attributed to aluminium. Our tests show that both in beetles and

birds, where blue, violet, red and blue-green pigments are present, the aluminium content is greater than in the case of the other pigments. It is certainly an interesting parallel that nearly all the plants which prefer dry surroundings, the flowers of which are poor in aluminium, or contain none at all, are *white or yellow in colour.* Surely there is a connection between the plant and animal kingdoms as regards the formation of bright pigments !

An observation of aluminium in the mineral kingdom leads to the conclusion that it is found in the brightest gems. Its compounds are found for instance in corundum, ruby, sapphire and oriental amethysts, emeralds, etc., in which these compounds cause the brilliant colours.

An observation of *colour formation in the mineral, plant and animal kingdoms* leads to the discovery that aluminium plays a mysterious part in the formation of the bright colours of nature. It is taken up from the soil by the roots of plants, and through its agency magnificent red, blue and violet flowers are formed. The plants serve as food for animals, and when aluminium thus enters the animal kingdom, it participates in the formation of the delicate and beautiful colours of animal organisms. That aluminium besides iron is also present in animals' blood was shown by our analyses.

Not less important was the rôle of aluminium in the *vital processes in the past.* If we glance at the plant life of former ages, the impression is gained that the flora of those times developed under especially favourable conditions, attaining a luxuriance of which we to-day can with difficulty imagine. The plant world which yields us the coal in use to-day, developed in extensive marshes and morasses, under a mild, equable climate, free of frost, and in over-grown flat lowlands and the banks of waters having a soil rich in organic matter. Those plants which absorbed the moisture were mostly cryptogams.

The fossil cryptogams, like shave-grass, club moss and ferns, were, and are, plants which absorb comparatively large quantities of silica, aluminium and iron. In general it may be said that the absorption of nutrient matter, and the whole structural and metabolic process in a large number of fossil and living cryptogams, proceeded and proceeds quite differently from that of phanerogams. The former, especially peat moss (sphagnum), avoid nutrient substances containing phosphorus, potash and possibly calcium.

In soil where peat moss and similar plants abound there is a slightly

acid reaction, through which the injurious influence of hydroxylions is entirely excluded; here the nutrient medium contains iron and aluminium in large quantities, also sulphur in the form of iron sulphates was met with in large amounts. To aluminium fell the task not only of inhibiting the injurious influence of iron on the plant organism, but also to check the reabsorption of potash and phosphorus, in order to protect the normal exchange of energy and matter. Aluminium consequently regulated the absorption of the ions only, through the radical system of the plant, in the earlier periods of the earth's history, for which purpose it was present in the soil under the predominating form of humates. The flora of those times, which formed the extensive coal seams, had no great need of phosphorus and potash, and were satisfied with the elements which exist in large quantities in the soil, viz., silica, aluminium and possibly lime. As our tests showed, a large accumulation of potash and phopshorus might have been injurious to the plant growth of those times. That this was not so, and that the early flora developed in great luxuriance, is due to the physiological influence of aluminium, from which it may be concluded that, to-day, *without aluminium there would be no coal.* It must also be remembered that the enormous plant development which produced our pit-coal and lignite, was rendered possible by exceptionally favourable growth conditions and *high radio-activity* of the soil and atmosphere. Also note that the flora of the different geological epochs, the rocks of which show high radio-activity, attained enormous dimensions, contrary to that of the chalk formation, for instance, which shows no radio-activity and in which no coal was formed.

The early flora, especially the cryptogams, were able to obtain the aluminium and silica necessary for the changes in their structural matter, besides the other vital elements. Through the intensive respiration processes of these plants, which lived in community with fungi and bacteria, enormous quantities of carbonic acid were produced. In the decomposition processes of organic matter, large quantities of organic acids were also formed; these two agents then brought about the formation of china clay, of the volcanic rocks and crystalline schists, slowly but surely, and produced a very suitable nutrient medium for the development of the cryptogams. These elementary phenomena and processes afford us a glimpse into the fundamental function of aluminium in the great storehouse of nature.

In the present age aluminium plays an important part in soil

reaction. DAIKUHARA (1) first called attention to the fact that if calcium chloride be added to a soil which is poor in lime and rich in aluminium, iron-oxide and silicic acid, the following reversible processes take place:

$$\begin{array}{llll} Al_4\,(SiO_3)_3 & +\ 12\ KCl & \rightleftarrows 3\ K_4SiO_4 & +\ 4\ AlCl_3 \\ AlCl_3 & +\ 3\ H_2O & \rightleftarrows Al\,(OH)_3 & +\ 3\ HCl \\ K_4SiO_4 & +\ 4\ H_2O & \rightleftarrows 4\ KOH & +\ H_4SiO_4 \end{array}$$

The American authors VEITCH (2), L. HARTWELL and F. R. PEMLEER (3), and CROWTHER and RUSTON (4), expressed the opinion that the free hydrochloric acid formed has a poisonous effect on the root system of the plant, and H. KAPPEN, basing on this reaction, suggested the so-called *soil acidity exchange*, and this acidity is now being determined by the colorimetric and electrometric methods in the reversible process, which takes place on the addition of calcium chloride to the soil.

H. KAPPEN (5) expressed the opinion that these exchangeable-acid soils have a particularly injurious effect on crops, owing to changes which occur with the salts used in fertilising, in conjunction with aluminium salts, which, both on account of their acid nature and their aluminium content, are injurious to plant growth. The sensitiveness of crops to this form of soil acidity is by no means equally great in all cases. Barley, turnips, red clover, peas, beans and lucerne, also mustard, according to KAPPEN's growth tests, suffer considerably under this form of acidity; while oats, maize, potatoes, serradella and yellow lupins bear a comparatively high degree of exchange-acidity fairly well.

The physiological and biochemical tests which we have made, both in the hothouse and in the experimental field, with an application of 1-8 q. of aluminium chloride and aluminium sulphate per ha. (which was worked into the soil to a depth of 20 cm.) do not confirm KAPPEN's opinion, for the aluminium chloride and aluminium sulphate, in quantities of 4-6 q. per ha., had no injurious effect when used on barley,

(1) G. DAIKUHARA. *The Bull. of the Imp. Agr. Exp. St. Japan*, 1914, 1; Jahresber f. Agrikulturchemie 55, 1914.

(2) *Journ. of the Amer. Chem. Soc.*, p. 637. 1904.

(3) Report Agric. Exp. Stat. Kingston, R. S. 1907.

(4) *Journ. Agric. Sci.*, 4. pp. 25-55, 1911.

(5) H. KAPPEN. On forms of soil acidity and their importance in plant physiology. *Landw. Versuchs-Stat.* Verlagsbuchhandlung Paul Perey, Berlin, 1920.

wheat and turnips, nor on red clover, peas, beans and lucerne, nor mustard.

We further found by our tests that the aluminium chloride and aluminium sulphate in the soil have not such a toxic effect as in the artificial nutrient solutions in water cultures. There is a great difference in the toxic effect of aluminium in artificial nutrient soutions and in the soil. The water culture tests proved that even by the use of 0.002 atomic weight of aluminium per litre of nutrient solution, a decrease in the production of vegetable matter was observed. This concentration corresponds to 0.267 gm. anhydrous aluminium chloride per litre, and 6.0 cc. of 0.1 normal soda is required to neutralise 100 cc. of this solution. By further tests it was found that the aluminium-ion, in the form of aluminium sulphate, in a concentration of 0.005 atomic weight per litre of nutrient solution, caused a great decrease in plant growth: 0.006 atomic weight of aluminium in the form of aluminium sulphate was likewise very injurious to the growth of all plants. With 0.0085 atomic weight of aluminium in the form of aluminium sulphate per 1 litre of nutrient solution, *Hordeum distichum*, *Triticum vulgare* and *Secale cereale* died after 36 days. *Polygonum fagopyrum* and *Avena sativa*, showed poor but continuous growth. With 0.01 atomic weight of aluminium in the form of aluminium sulphate, all plants died after 19-24 days.

It was found that in soils containing only 0.1 % of calcium oxide and 2.2 % of carbon in the form of organic matter, 0.04-0.05 gm. of aluminium in the form of aluminium chloride per kg. of soil, had no toxic effect on the growth of barley, wheat, rye, oats, red clover, lucerne, beans, turnips, potatoes and maize. Only when the quantity of aluminium in the form of aluminium chloride rises to 0.06 gm. per kg. of soil, is a depression observed in the initial growth stage of barley, wheat, red clover, lucerne and turnips; a slight toxic effect from aluminium chloride was especially observed on clover and turnips. Aluminium in the form of aluminium sulphate at a concentration of 0.06 gm. of aluminium per kg. of soil had no injurious effect on any crop, on the contrary it even had a stimulating effect on oats, rye, maize and potatoes.

The richer the soil in decomposed organic matter, the stronger is the combination of aluminium sulphates and aluminium chlorides which can be used without any injury to plant growth.

All the plants on which pot growth tests, were made take up aluminium in larger or smaller quantities when it is applied in an

assimilable form; this applies not only to the soluble aluminium salts, but also to certain aluminium compounds insoluble in water.

In the water growth tests, on the contrary, the soluble aluminium salts, even when greatly diluted, though in specifically unequal degrees, have an injurious effect on the growing roots. From our experiments it is concluded that specific permeability exists in the root system of the plants, and also that specific reactions of the plasma colloids take place and that chemical processes of the plasma constituent parts take place under the influence of aluminium. The whole mechanism of the absorption of aluminium is connected with the exchange of cations. The stopping of the absorption of the antagonistic cations, i. e. the reciprocal reduction of the absorption of manganese or iron, was clearly proved by our tests.

Field, garden, meadow and forest soils, however, removed strikingly large quantities of soluble aluminium salts and aluminium chloride. Certain small quantities of aluminium salts may indeed have a stimulating effect on plant growth. Aluminium sulphate and aluminium chloride have considerable poisonous influence on field, garden, meadow and forest soils.

It should be remembered that aluminium in the form of aluminium chloride and aluminium sulphate, in the soil have different effects on plant production than in the case of water cultures. The reciprocal chemical exchange processes in the soil give rise to various reactions, which naturally exert an influence on the production of vegetable matter.

Why in the presence of aluminium compounds, the poisonous influence on field soils ceases, still remains to be determined. The hydrogen-ions are not invariably neutralised. It was noticed that in soils in which there was no calcium carbonate nor magnesium carbonate, the same influence was exercised by the various concentrations of aluminium sulphate or aluminium chloride as in humus sand soils to which 2.5-5 % of calcium carbonate had been added.

In general it may be said that those soils to which calcium carbonate was added removed more aluminium sulphate and aluminium chloride.

I am of opinion that the antagonistic influences of the various cations, which are present in the soil in such large quantities, play a large part in this connection, in consequence of which the toxicity of the aluminium does not attain such a high degree as in water growths, where a large accumulation of cations cannot take place.

It was noticed that with sand leached and heated with hydrochloric acid, the same results were obtained as with water cultures. Aluminium in the form of sulphates, chlorides and nitrates in small quantities had an equally toxic effect. A large part is played by humus matter in the soil which, with aluminium, probably forms humates and has no injurious effect on the root system of plants.

If sterilised, hydrolised and neutralised peat were added to the sand soil, we were able to use up to 0.06 gms. of aluminium in the form of aluminium sulphate or aluminium chloride for barley, wheat, and sugar-beet crops, in the presence of all biogenetic elements, whereby these crops developed normally. In sand without organic matter the early growth of barley, wheat and sugar-beet, in the presence of all biogenetic elements, with a concentration of 0.06 gm. of aluminium in the form of aluminium chloride per kg. of soil, was greatly injured and in many cases the plants died.

We are now firmly convinced that if the soil acidity, expressed in hydrogen-ion concentration, is $P_H = 1.4$, it has an exceptionally injurious effect on plant growth through the presence of SO_3- and SO_4-ions, of industrial waste products, or coal mines, burning cinder heaps, coke-furnaces, etc., or when the hydrogen-ion concentration has arisen from the decomposition of pyrites. In the majority of moist soils, rich in organic matter, the injurious acidity is caused by the natural humic acid. The statement that aluminium compounds in the soil have an injurious effect on plant growth, is based on no exact, experimental foundation.

Prof. Dr. Julius Stoklasa,
Director of the State Experiment Station of Czecho-Slovakia, and Professor of the Higher Technical School, Prague.

A BIO-GEOGRAPHICAL CLASSIFICATION OF THE PRINCIPAL CROPPING SYSTEMS OF THE WORLD.

Plant Sociology has for some years been the object of profound research. Since the fundamental work by Prof. E. WARMING and the publication of the important memoir by F. E. CLEMENTS on the dynamics of plant associations, a considerable number of books have been published on the various plant groups existing on the surface of the globe and their evolution. Botanists have been mostly engaged with the natural associations. They have indeed shown, and A. de CANDOLLE was one of the first to do so, that man has a considerable influence on plant life, which has often been transformed by him, but no naturalist, so far as is known, has examined in detail all the modifications produced. In every country, however, man has substituted for the primitive associations his cultivated crops: the floral composition of pasture and prairie has been transformed, and forests more or less modified. As a matter of fact, four-fifths at least of the land surface of the world is covered with vegetation which has been greatly modified by man and is formed of *artificial associations* or *secondary formations* some of which were produced thousands of years ago and which man maintains in a state of comparative stability, voluntarily or involuntarily, by keeping up the action of the causes which produced them. I have already shown in previous works that the great African forest — the virgin forest of STANLEY — is for the most part only a *secondary forest* formed on the site of ancient growths; it actually forms a long interval of fallowing in the Bantu system of agriculture: the "landes" of the west of Europe, the "savarts" in Champagne, the "garigues" (waste lands) and marshes of the Mediterranean region are also mostly associations re-formed on the site of former growths, or of forests which have been destroyed. Such also is the fallow subjected periodically to the process of weeding, burning and scattering the ashes over the soil, forming the system

of cultivation known in British India under the name of " rab ".

Lastly may be mentioned the *terrace cultivation*, practised for several thousands of years on the borders of the Mediterranean, in China, in the Malay Archipelago and by the Indians of South America. Gigantic operations have been necessary to transform whole mountains into the form of an amphitheatre, and these areas rising in stages, which are to-day in many countries covered with brushwood and uncultivated savannahs, were formerly exploited for the production of abundant crops ; the terrace arrangement was undoubtedly the only system ensuring a good yield by the soil, and was practised by peoples living far from one another and doubtless ignorant of one another's existence.

When we speak of agriculture, we often think of methods of cultivation which have been practised in Europe, or in countries inhabited by Europeans for some centuries. We lose sight of the fact that in numerous regions of the globe there exist systems totally different from ours, but which no doubt also have their reason for existing. In Europe itself the systems have been modified in the course of centuries and will no doubt be still further modified in the future. In this preliminary work we have tried to show how the different methods of cultivation are linked together.

The systems of cultivation and of the associations which result therefrom, form an important branch of applied ecology. We may call it the practical application of plant associations, since it really concerns plant associations created or modified by man with a view to advantages he wishes to derive from them. Among the plant associations belonging to this class, some are created voluntarily by man, while others are formed involuntarily through his agency ; the latter include the rough and overgrown groups, fallow lands, open pasture lands, secondary forests, etc.

In this description, which is believed to be the first comprehensive attempt at grouping cultivation associations, we review the systems of cultivation and the associations arising therefrom, especially utilising the observations made in the course of travels in Africa, Asia, the Malay Archipelago and various parts of Europe. Use has also been made of the publications by V. Mosseri on agriculture in Egypt, those by E. Buck on the *rab* in India, Vanderyst on Bantu agriculture on the Congo, Perrier de la Bathie on plant associations in Madagascar, etc.

Generally speaking, all the systems of cultivation practised

in various countries are adapted not only to topographical and climatic conditions and the state of pre-existent, spontaneous vegetation, but also to social and economic conditions and the state of civilisation of the peoples who practise this cultivation. It is clear that in countries where the population has progressed but little, is sparsely scattered and has at its disposal unlimited areas for cultivation, or in those in which the products from hunting and fishing are abundant, man has improved his agriculture less than in those in which the population is very dense and has already attained a high degree of civilisation. This nevertheless does not always imply that he has had less influence on the spontaneous vegetation, as is shown in the following.

FIRST SERIES. — PRINCIPAL SYSTEMS OF CULTIVATION COMING UNDER THE DOMAIN OF AGRICULTURE PROPERLY SO CALLED.

I. — ABSENCE OF CULTIVATION AND STOCK RAISING.

Man lives exclusively on what he gathers, either by hunting or fishing. Generally (except in regions where he may burn the herbage) he does not deteriorate the primitive vegetation. This system is practised by the Negrillos of the Equatorial African forest, by the Esquimos of the Polar tundra and by the Fuegians of South America.

II. — SYSTEMS OF EXTENSIVE CULTIVATION.

(*A*) **Systems of incomplete cultivation or stock raising,** often combined with fruit gathering and sometimes with hunting and fishing. The primitive vegetation is to a great extent preserved but is modified over large areas.

(*a*) **Stock-raising without agriculture.** Subjected to the movement of the seasons in order to ensure a continual water supply for the herds and pasture in which vegetation has remained apparently more or less primitive, but in which nevertheless the domestic animals have been instrumental in disseminating certain plants and eliminating others.

(1) Reindeer-breeding in the Arctic regions: the composition of the tundra is scarcely modified.

(2) Camel and dromedary breeding in the desert: flora

but little modified, but all woody plants, if constantly browsed, take on an altered aspect and fructify little.

(3) Breeding of cattle or sheep in the mountainous or semi-arid regions of temperate countries: the primitive vegetation is greatly modified, cattle-grazing prevents the re-formation of forest: pastoral populations (for instance, in the Alps, Pyrenees, Corsica, etc.).

(4) Cattle breeding in warm sub-temperate countries and in tropical regions: the forest is replaced by savannahs and semi-natural prairies, generally burnt in the dry season, and the primitive steppe is replaced by modified steppes or pasture; the nomad tribes of the Soudan, Arab tribes of Baguirmi, and Masai of the Belgian Congo (*primitive pastoral system*).

(*b*) **Sedentary or semi-nomad agricultural life. Agriculture without large livestock.** No ploughing, or only in exceptional cases (par. 7 & 8): the hoe is the principal agricultural implement.

(5) Cultivation in dense tropical forest: felling of the primitive forest and fallowing at long intervals, leading to the formation of the secondary forest, sometimes of palm plantations and occasionally (in Asia) of bamboo forests; *Bantu system in Equatorial Africa* (in Lower Congo, " Vooka " is the name given to the place in the forest which is cropped every 10, 15 or 20 years and where the village is periodically established); " *des rays* " *system* practised by the Moïs in Indo-China.

(6) Utilisation of park-forest or savannah in tropical regions: Partial felling of the forest, sparing useful trees; fallowing for relatively long periods (generally 6 to 12 years) with frequent firing of grass; after being left for some years the soil is again cropped: *System of agriculture in countries without cattle in the African Guinea zone* (various Soudan peoples in the Middle and Upper Niger, Bandas and Mandjias in the Ubangui, etc.).

(7) Cropping in countries which are flooded naturally in the rainy season, the cultivation being carried on during the period of inundation: Planting takes place each year on the same soil, sometimes worked into high ridges, except in the case of rice, the lower part of which is submerged. Sorghum is sown on the top of the ridges standing out of the water, which occupies the bottom of the furrows for at least a part of the time during the growth of the plants; aquatic or semi-aquatic weeds may

be grown between the ridges. After the harvest and when the waters have subsided, herbaceous growth on fallow: *system of rice plantations in a state of protocultivation,* in certain regions of Asia. *Cultivation of sorghum on high ridges* among the Saras and Baguirmiens of the South, in Middle-Chari.

(8) CROPPING OF NATURALLY INUNDATING SOILS AFTER THE WATERS HAVE RETIRED. Sowing is generally done while the soil is still in the mud state. The soil previously occupied by waterside plants has been finally cleared. The crop occupies the soil from 3 to 5 months, profiting from the moisture which remains in the ground. During the same period a large quantity of weeds and annual waterside plants grow up, the seeds of which have remained in the soil from former years or have been carried thither by the flood. After the harvest the soil generally becomes hard, dry and cracked and the weeds dry after having matured their seed. In Egypt the name of *charaqi* is given to this period of fallow; afterwards the soil is again covered for a longer or shorter period until the next crop. System of cultivation on the borders of the Nile in ancient Egypt and until the beginning of the 10th century (the *Baali* cultivation). Cultivation on the banks of the Senegal, Niger, etc. *Chamcars* on the banks of the Mékong in Cambodia.

(9) DRY-FARMING on the semi-arid steppes. Sowing broadcast on deeply ploughed soil; cultivation of soil surface after each rainfall. After the harvest the soil is left fallow for one or two years (bare fallow). *Barbary agriculture* in North Africa, Indian of the arid regions of America.

(10) TERRACE CULTIVATION in mountainous regions. To reduce the effect of erosion and retain the greatest quantity of water in or on the soil, the arable land is arranged in horizontal terraces one above the other in the form of an amphitheatre. The primitive vegetation is completely eliminated and only weeds or semi-cultivated varieties remain. Fallowing for one year, every other year, or no fallowing, according to soil fertility. *System of terrace cultivations* practised in China, the Malay Archipelago, around the Mediterranean, in the Canaries, by the Indians of the Cordilleras and Andes, etc.

(*B*) **Agriculture and cattle rearing, but not, or very little, in association.** No ploughing, or only with a primitive implement,

burning and scattering the ashes over the soil and incinerating the animal manure when the latter is used.

(11) Cultivation on the site of the primitive or secondary forest. Fallowing for a longer or shorter period, the land serving as pasture. Brush or forest firing frequent. Formation of pastures of quick-growing associations of grasses (*Imperata cylindrica* is often the dominant grass in tropical countries, and in Champagne *Poa compressa*, etc.) and annual grasses, the seeds being often brought by the cattle or preserved in the soil. After some years of varied crop cultivation the soil is again left for a period of 5 to 10 years to the tropical bush, secondary forest or grass fallow according to the region. System of cultivation by the Mans of Tonkin and by different tribes of West Africa. System followed in various regions of Europe until the 15th century. The present system of burning and scattering the ashes in the "landes" of certain parts of Brittany.

(12) Cultivation in park-forests and tropical savannahs. Grass leys sometimes several years in succession, alternating with fallow (copse-pasture or Savoka of Madagascar). Manured sometimes with burnt animal manure after the last harvest; when the soil is exhausted the land is abandoned, and at first only weeds grow on it, or semi-cultivated ruderal species, which disappear after the second year. Then appears a growth of jungle and young copse, which again forms, after some years, a secondary clearing-forest with certain species of dominant shrubs. After a further period of some years it is again cut and burnt, the useful trees being generally, however, spared at any rate in West Africa. *Known as the system of Savoka cultivation in Madagascar.* Cultivation by sedentary Peuhls at Fouta-Djalon and by the Bambaras in the French Soudan.

(*C*) **System of complete cultivation and livestock rearing.** Peasant farming: use of the plough; cattle and arable farming; utilisation of animal manure.

(13) The system includes fields and fallowing, and land burning; animal manure is spread over the soil after having been burnt. After one or several croppings, the soil is left fallow and then serves as pasture. At this point scarcely anything but weeds grow, all woody vegetation having been exterminated. Hence when again (after 2 or 3 years) burning and ash-spreading is carried

out, branches and twigs must be brought from the neighbouring hedges or forests and burnt at the same time as the grass tufts and manure. The cinders and burning of the soil (which cause the death of certain injurious micro-organisms) fertilise the ground. *Rab system* in West India and at *Ladang* in the Malays.

(14) THIS SYSTEM COMPRISES PERMANENT FIELDS WHICH ARE NOT BURNT, but in which fresh animal manure is ploughed in during tilling; sometimes also burnt lime, marl, etc. are incorporated into the soil. Save in exceptional cases the land is no longer left fallow after 2 or 3 harvests according to certain associations. Spontaneous vegetation has been completely exterminated and replaced by weeds or semi-cultivated species which live in the midst of the cultivated plants and re-sow themselves annually unless the crops are weeded. In addition to the fields there are generally permanent grasslands, which serve for pasturing cattle. *Peasant cultivation of temperate countries.*

(15) EXPLOITATION IS EXCLUSIVELY CONFINED TO IRRIGATED CROPS; the most usual are the rice plantations of the Far East. The soil is ploughed with the aid of buffaloes while it is still wet; it is manured with fresh animal manure; the rice is sown on the spot or transplanted and numerous half-spontaneous aquatic weeds (Cyperaceae, etc.) grow up with the rice. Immediately after the harvest, or even a little before, the soil is dried, cracks, and remains bare or is covered in places with small annual plants of quick growth which have time to seed before the renewal of artificial inundation. Rice is cultivated every year regularly on the same soil, which yields one crop (in Cochin-China) or even two (in Tonkin). System of *irrigating by inundation*: native rice plantations irrigated by the deltas of the Mekong, Red River, Burmah, South China, etc. Elsewhere the crops grown are only flooded between the rows at certain times: irrigated cultivation of cotton, sugar-cane, etc.

III. — SYSTEMS OF INTENSIVE CULTIVATION.

The soil is cultivated almost continuously and the stubble ploughed up shortly after the harvest in the case of annual crops. Weeds are almost entirely eliminated. The soil is kept fertile by suitable dressings of manure produced by livestock, or by chemical fertilisers or green manures (leguminous crops ploughed in green). It is irrigated or watered in countries where this is necessary. The

crops grown are generally selected varieties and some are treated periodically with insecticides or fungicides.

(16) Herbaceous crops in rotation: cereals, leguminous or green crops in temperate countries: sugar-cane and rice or maize and then leguminous crops in tropical countries: sometimes also, as in the south of the United States, a woody annual, cotton, alternates in rotation with cereals and leguminous plants. *High yield system of agriculture* (for instance in France in the Nord Department and in the Beauce, in the United States, China, etc.).

(17) Woody plants occupying the soil for many years (tea, coffee, cocoa and rubber in tropical countries, vines and orchards in temperate countries). The soil is sometimes bare and without weeds, but ploughed, and sometimes surface cultivated between the bushes periodically; sometimes also the grass is allowed to grow and periodically ploughed in. Some of these crops require the shade of trees, and often last for a long period. In certain rich soils of South America, a coffee plantation may last more than 50 years on the same soil.

(18) Mixed crops of woody quick-growing plants and annuals. When the plantation of trees or palms is not too dense the spaces between are utilised for growing shrubs or herbaceous plants. Cultivation system of Lower Normandy where the fields of cereals are generally planted with apple-trees. *Oasis system*, where various crops prosper under date-palms. Tea plantations in Ceylon shaded by rubber trees.

(19) Intensive cultivation with irrigation. This system is similar to that mentioned in paragraph 15, but improved (intensive manuring, cultivation of selected varieties). Rice cultivation in Spain and Italy. *Irrigated high-yield crops* of sugar-cane in Java and of cotton and cereals in Egypt and Arizona. Even under this intensive system, according to Mosseri, the *charagi* fallow should be maintained as long as possible in order to increase soil fertility.

IV. — ARTIFICIAL SYSTEMS OF CULTIVATION.

The soil is generally brought to its modified composition by constantly renewed manurings. In such conditions the plants often show an abnormal increase in growth.

(20) Garden crops in the neighbourhood of towns, China-Annam horticulture, human excrement being utilised.

The following may also be cited as examples of artificial cultivation: hothouse, hotbed, forcing-ground, mushroom-beds in old quarries.

SECOND SERIES. — SYSTEM OF GROWING CROPS AS FEED FOR LIVESTOCK.

Though in the preceding series we have treated this subject in connection with agriculture properly so-called, we will again examine by what means the wild flora may be modified so as to serve as stock feed.

In pastoral or semi-pastoral countries, man has from the earliest times transformed the aspect of plant life by the special cultivation (pasture and grassland) of what serves as a feed for his herds. Nevertheless he has not always needed to eliminate completely wild plants as was necessary in the case of agricultural crops properly so-called. In every country, the stock must generally be content with the uncultivated plants of the country. The uncultivable tracts are reserved as permanent pasture. Often the sites of devasted forests, marshes and fallow-ground are left to the livestock. The primitive plant-life associations are gradually modified by the stock and also by the frequent intervention of man. The associations serving as pasture may be divided into the four following groups:

I. — GRASSLAND.

This name is given to the prairies, steppes and marshes which have partially retained their primitive vegetation. The trampling and grazing of cattle, however, have resulted in eliminating certain species and spreading others. Man also intervenes by extirpating or burning shrubs and plants not utilisable as feeds. In tropical countries brush fires are generally resorted to for the formation of pasture and often result in eliminating a large number of species, and so the flora of these pastures is very poor. In temperate countries man has left for grassland soils which are too poor for cultivation or too moist for growing cereals. These pastures often occupy the site of former forests. Cattle-grazing and the frequent intervention of man prevent their re-forming. Erosion also has often led to the formation of vegetable mould and a xerophytic type of plant is the only one possible for long periods on these greatly

impoverished soils (mountain pasture, Champagne " savarts ", short grasses on denuded rocks,etc.). Finally, many pastures were formerly cultivated soils which have been left fallow for a longer or shorter period.

II. — HAY MEADOWS.

A name given to pastures generally well kept and intended for hay, where mostly only forage plants belonging to the wild flora remain ; some foreign varieties have also been sown occasionally. In the temperate countries of the Northern hemisphere, they are only grazed after mowing and sometimes in Spring ; the grass is afterwards allowed to come up, flower, and is cut on reaching full growth, while certain kinds have already shed their seed. They are often cultivated to some extent (through drainage or irrigation, manuring, sometimes sowing with certain leguminous plants and grasses) so that the primitive vegetation is often greatly modified, though the permanent grass covering allows many useless or injurious species to subsist. In countries with high cultivation, these meadows generally occupy the valleys.

III. — GRAZING-LAND.

This name should be reserved for unmown meadows for intensive breeding (J. du PLESSIS de GRENEDAN). Cattle are kept almost the whole year on this land which is fertilised by their manure. The soil, constantly manured and enriched by fertiliser when it is not sufficiently calcareous, is covered by wild plants or by the artificial sowing of various species of grasses and leguminous plants which the cattle constantly crop, preventing them from flowering and seeding ; the bare spaces also, as soon as they occur, are covered by the growth of the plants ; development of tufts and growth of rhizomes or runners. Certain plants not eaten by the cattle, on the contrary, form tufts here and there and seed ; they would end by predominating if not removed periodically by man. The soil, for grass-bearing, should be deep, compact and moist, and the climate should be rainy a great part of the year. In Europe the quarternary alluviums, clays and lias marls up to the Cretaceous formation are especially suited to this growth, which requires the frequent intervention of man. In certain countries grass is planted with fruit-trees. A mixed growth of *grazing orchards* is then formed as for instance the grass-orchards of cider-apples in Lower Normandy.

IV. — TEMPORARY GRASS CROPS.

The fields of lucerne, clover and sanfoin, in fact all the forage leguminous plants and sometimes also the grasses (cereals cut green, rye-grass in Europe, and Para and Guinea grasses in tropical countries) come under this group. They are actually crops in rotation with cereals, only occupying the soil temporarily, and therefore come within the domain of agriculture properly so-called. Temporary grass crops only came into practical agriculture in Europe within the last 100 or 150 years, and hardly yet exist in tropical countries.

THIRD SERIES. — SYSTEM OF FOREST CULTIVATION.

The forest associations exploited (*sylvicultural associations*) are less modified than the associations of grasslands preserved by man for livestock. At first these associations seem natural; generally speaking all the species which combine to form them are wild; they are exploited however so as to preserve or cause to predominate the most profitable species. Here indeed it is a question of real cultivation. Species of underwood, almost all useless, have not been eliminated and the majority have adapted themselves to the new conditions. In certain countries however real artificial forests have been formed, especially within the last century or two, and have replaced both natural forests and other associations (maritime pine plantations in the S. W. of France, regrowths of *Pinus sylvestris* in the centre and west of France; forests of teak and Peruvian bark in Java, etc.). These forests, created entirely by man, cannot be distinguished from the natural, preserved forests: the surrounding vegetation has become accustomed to living among the underwood. In their mode of development also they do not differ from the other forests exploited by man. All the intermediate forms between a primitive forest and a forest preserved by sylviculture as subjected in one way or another to intensive cultivation, are met with here. Forest preservation is, by the way, comparatively recent. In France, where systems of forest exploitation seem to date back earlier than in most other countries, COLBERT's statute regulating felling and staddling with due regard to the nature and longevity of each species, was framed in 1669. In most tropical countries forest preservation does not yet exist or is only rudimentary, with the exception however of

the remarkable forest preserves in India, Burmah, Siam, Cochin-China, Java and the Philippines, which, though mainly established less than 50 years ago, already look like the best preserved forests of Europe, and are scientifically treated. The forests of tropical Africa on the contrary are steadily degenerating, all useful species being taken or destroyed, in order to plant non-permanent food crops in their place.

The following is a brief description of the principal systems of forest regeneration and exploitation :

I. — FORESTS NEITHER KEPT UP NOR DEGENERATED.

These have been subjected for centuries to the exclusive influence of natural factors : *Primitive forest.* Such forests exist in very sparsely populated countries. Generally, even in temperate regions, the species are very mixed.

II. — FORESTS PARTIALLY DAMAGED BY MAN.

These re-form slowly into natural forests, either through the agency of climatic factors or through the intervention of man (sowing or plantations), passing through the successive stages of brushwood and secondary forest.

A large number of forests have been thus formed ; they are generally not very homogeneous ; the less damaged places have retained a dense growth, the others are only covered with sparse copses, patches of moorland, etc. They have not yet been completely preserved by man ; such forests are also often in a poor condition owing to fires, voluntarily or otherwise caused, and to excessive felling, grazing, and treating with a view to encouraging the breeding of game for shooting or hunting, etc.

III. — FORESTS RE-FORMED AFTER HAVING BEEN COMPLETELY DESTROYED FOR GROWING CROPS.

After the soil has been exhausted it is abandoned and the forest gradually re-forms into natural forest, passing through the following stages in temperate countries : 1. grassland ; 2. moorland, scrub or waste land ; 3. thickets and brush ; 4. *secondary forest* ; 5. secondary forest of primitive aspect (*final climatic association*). These forests consist of very mixed species, badly preserved and not very profitable. In equatorial regions regeneration is quicker and the passage is abrupt from bare land to more and more complex secondary forest.

IV. — SEMI-NATURAL OR COMPLETELY ARTIFICIAL FORESTS PRESERVED AND UNDER MANAGEMENT.

These forests are of numerous kinds, with very varied forms of cultivated associations, of which the chief are:

(*a*) **High Forests of pure species.** (*i. e.* the plantations are of one species only). — The broad leaved species are distinguished from the *resinous*. The plantation in which the trees are of the same age and that in which they are of different ages should also be considered. In the first case they are exploited by a single felling; the plantation passes through the stages of thicket, coppice, young saplings, until after 80 to 150 years, according to the species, the stage of maturity is reached. In the second case it is exploited by successive fellings. Apart from felling, such plantations require special treatment (felling for clearings, replanting or sowing in bare places, etc.).

(*b*) **Mixed Forests.** — The trees may be grouped according to their characteristic into three categories: *shade species* alone; *shade* with *non-shade* species; *non-shade* alone. The trees however are generally unequal and form mixed groups or clumps. Thus the willow and beech are often associated in the middle region of the Alps. The methods of exploitation and upkeep are the same as for the plantations of the preceding category. Human intervention is often necessary to maintain the equilibrium, certain species having a tendency to encroach.

(*c*) **Underwood under Standard,** is a more or less artificial growth composed of two elements: (1) a lower stage exploited at regular intervals such as *ordinary coppice*; (2) a higher stage of irregularly scattered trees, of varying age, the youngest being *saplings*; the trees are treated by *successive fellings*; the rejuvenation of the coppice is ensured by making clearings. In tropical countries the plantation passes through 2 or even 3 stages.

(*d*) **Ordinary Bush.** — These are growths which can spring up again after each felling through the growth of shoots from the stumps and of suckers which are put forth when the trees have been levelled to the soil. The leaf species alone possess this property in varying degrees. The shoots spring from the felled stumps

after the beginning of Spring and grow, forming clusters, then vigorous clumps, leaving clear spaces between one another. No tree predominates in the ordinary coppice. The latter is exploited sometimes at close intervals of time (12 or 15 years), sometimes at longer intervals (25 or 30 years) when the shoots have attained *pole* dimensions.

The ordinary coppices and those under plantations may be formed of pure species, but more often of very mixed varieties.

V. — ARTIFICIAL FORESTS FORMED OF NON-INDIGENOUS SPECIES.

In many countries man has created new forests or has restored the devastated forests by sowings or planting species originally foreign to the region which have become naturalised therein, their seeds being generally able to resow themselves naturally. The marine-pine forests in the Landes, and the increasingly important growths of *Pinus sylvestris* and other conifers in the centre and west of France, have thus originated. In both cases these are native species from neighbouring regions; but species coming from very distant countries (American oaks acclimatised in France, Australian eucalyptus planted on the Roman plain and in Algeria, etc.) may also, if the climate suits them, become naturalised and finally form new forests, very far from their native country. Various French forests already show numerous species of exotic trees, more or less disseminated among the native growths.

FOURTH SERIES. — SYSTEM OF CULTIVATION IN AQUATIC SURROUNDINGS.

Rice plantations which remain inundated almost permanently and the plants of which are immersed in the water to a certain depth from the beginning of the growth period until earing, constitute a real aquatic crop. The floating rice cultivated in certain lakes in Cambodia, can live over a depth of 2 to 5 metres of water; the plant rises with the flood, but the daily rise of the water should not be more than 10 to 12 cm. for the rice to keep pace with it. China specialises in numerous aquatic crops: *Nelumbium*, *Trapa* or water chestnuts, *Ipomaea aquatica* and various other potherbs grow in the water. The pools where these plants are grown are manured.

Finally, for some years in Germany there has been an increase in the yield in the fishponds through artificial fertilising. H. FISCHER has noticed that superphosphate placed in ponds causes the rapid increase of certain nitrogen-fixing water bacteria: *Bacillus asterosporus*, *Bacterium aerobacter*, *B. radiobacter*, etc. They take up the nitrogen of the air and transform it into albuminoids; reed compost also enriches the water with nutritive bacteria and phytoplankton, on which fish feed. Here again it is a question of a real aquatic growth crop.

***

This brief sketch illustrates the vastness of the field of the application of plant associations. It is a domain which has so far been little explored. It is worth while studying all agricultural methods, even the most primitive. They are almost all the result of long experience on the part of the races that adopt them. Modern science has explained practices which only a few years ago still seemed erroneous. In Europe, fallowing was justified when fertilisers only existed in very limited quantities, for it enabled the stock of nitrogen in the soil to be renewed. The long annual *charagi* fallowing practised by the ancient Egyptians, during which the soil cracked deeply, probably improved the soil of the banks of the Nile much more than the famous legendary oozes. The *rab* system followed in India, which consists in burning the surface soil and even animal manure, leads to a true partial sterilisation of the soil which favours nitrification, as has been shown by recent research. The Bantu system of agriculture followed by the primitive races of equatorial Africa, which consists in felling and burning the forest in order to replace it by food crops, is probably the only one which enables the black to live in countries where stock raising is not at present possible, where manures are unknown and where a constant struggle against the encroachment of the forest must be maintained. This system required harder work by the peasant black than is generally supposed.

The old systems doubtless are not immutable. Numerous improvements may be made in every one of them but preliminary research and tests on a large scale must be continued for a long time to come before methods of cultivation which are considered backward by the European, are replaced by better methods well adapted

to the climatic and the edaphic and social conditions of each country.

According to the happy expression of Prof. Ch. FLAHAULT, the object of all cultivation is to supply man with those plant products which are best adapted to his surroundings and needs; it should ensure a maximum of production for as long a period as possible, bearing in mind the special conditions of each locality.

It is necessary therefore, adds this author, to apply to the soil the same principle as is adopted in the economical management of a house: everything in its place. In cultivation the place for each thing is fixed by the climate, geographical position, local topography, nature of the soil, wild vegetation and stock of water available, no matter where the plant originated. Finally, the degree of civilisation of the population and its density are also of great importance. In Equatorial Africa where there is scarcely one inhabitant to the square kilometre, and in the delta of the Red River where there are more than 350 over the same area, agricultural systems are naturally different.

And so in improving the native agriculture of countries called backward, Colonial Governments should act with extreme prudence. In particular the error should be avoided of believing that methods of cultivation can be unified everywhere. The technical departments of these Governments should not only determine the *vocation* of each soil, i. e., fix the sites which will be reserved for permanent forest, grassland and agriculture, but should also take into account the method of cultivation best adapted to the climate, soil, and grade of evolution attained by the human inhabitants of that soil. Any attempt at agricultural progress in which this last factor is left out of account, would run the risk of failure, and almost always of delay.

AUG. CHEVALIER,

Chief of the Permanent Agricultural Mission of the French Ministry of the Colonies, Director of the Laboratory of Colonial Agriculture of the Higher School of Studies, Paris.

BIBLIOGRAPHY.

BUCK, Sir Edward. Rab: A System of cultivating Rice in Western India. *Monthly Bulletin of Agricultural Intelligence*, Year VI, No. 8, Int. Inst. of Agric. Rome, 1915.

CLEMENT, F. E. Plant Succession, an Analysis of the Development of Vegetation. Carnegie Institute, Washington, 242. 1924.

FISCHER, H. The Problem of Increasing Production in Fishponds by the use of Chemical Fertilisers. *Int. Rev. of Sc. and Pract. of Agric.*, Vol. II, No. 4. Rome, 1924.

FLAHAULT, CH. Eléments de Géographie botanique, 1901, (autographié).

— Les progrès de la Géographie botanique depuis 1884, son état actuel, ses problèmes, *Progressus rei botanicae*, 1907.

MOSSERI, V. Du sol égyptien sous le régime de l'arrosage par inondation, *Sultanic Agricultural Society*, Technical Section, Bulletin No. 12, 1923.

OLSEN, C. Studies on the Hydrogen Ion Concentration of the Soil and its Significance for Vegetation. *Comptes rendus des travaux du Laboratoire de Carlsberg*, XV, I, Copenhagen, 1923.

PERRIER de la BATHIE, R. La Végétation malgache, *Annales du Musée colonial*, Marseilles, XXIX, 1921, I-268.

TBAN-VAN-HUU. Note sur la culture du Riz flottant en Cochinchine. *Bulletin de l'Institut Scientifique de Saïgon*, II, 1920, pp. 46-52.

VANDERYST, H. Essai de classification des cultures pratiquées en Afrique occidentale. *Congo, Revue générale de la Colonie belge*, 1922.

— Système de culture des Bantu. *Congo Rev. générale de la Colonie belge*, 1922.

WARMING, E. Ecology of Plants. Oxford, 1909, German ed., Berlin, 1914-1918.

THE CULTIVATION OF LEGUMINOUS SEED CROPS IN ROUMANIA.

General considerations.

Roumania, from its geographical position in the south of Europe, at the gates of the Balkans, is the connecting link between two climates differing in characteristics, and each having considerable influence on agricultural conditions, systems of cultivation and the whole social-economic life.

In the Wallachian plain the climate of the Ukrainian steppe prevails, and extends over the southern half of Bessarabia till in the basin of the Danube it meets the Mediterranean climate, which, coming from the south-west, exerts its influence over Banat and Oltenia.

The curve of the Carpathians, which runs from west to east and then north, the group of peaks known as the " vestiques " of Transylvania, and the chains of hills in Central Moldavia which continue into the middle of Bessarabia in the forest region, impart characters of an orographical type which, in agreement with those of a natural order, form regions quite different from a climatic and agricultural point of view.

In consequence of this, within the present boundaries of Roumania, nearly all the morphological types of soil are found which have formed on the surface of the globe. The great majority of the typical agricultural areas, however, have soils formed under conditions of average or insufficient moisture, containing a large proportion of clay, considerable quantities of humus and a high percentage of salts nutritive to plants, that is, soils with good chemical qualities, and of which scientific agricultural treatment, by improving the physical properties, may still further considerably increase the productive capacity without the aid of chemical fertilisers.

Few of the typical agricultural areas receive an annual rainfall of more than 600 mm. The majority, those on which the agricultural

production of the country is chiefly dependent, receive 500-300 mm., have an average temperature of 9° C. or over, with sudden changes from winter to summer and autumn to winter, have long dry summers, heavy rains falling over a period of a few days, great losses of water by evaporation, and in consequence are regions of a typically arid or semi-arid nature.

The principal factor in the increase of agricultural production is water, a factor which may be influenced in various ways, for instance, by the improvement of methods of cultivation and agricultural technique.

As a logical consequence of natural conditions and of recent political conditions Roumanian agriculture, with the exception of that of certain parts of Transylvania and Bucovina, is chiefly of a cereal character. According to the statistical data of the Ministry of Agriculture for the year 1922-23, over a cultivated area of 10,712,073 ha., representing 36.3 % of the present extent of the country, cereals occupied 9,654,142 ha. or 90 %, while the chief leguminous crops covered only 274,289 ha., or 2.55% of the cultivated area.

On this area, in addition to leguminous crops grown for seed, the chief fodder crops are included, namely clover and lucerne. Deducting these latter, the leguminous crops grown for seed, such as beans, peas, lentils and broad beans, occupy 90,029 ha., or 0.82 % of the cultivated area.

During the years 1919-1923, the areas under the chief leguminous crops varied as shown in Table I:

TABLE I. — *Area under leguminous crops during the years* 1919-1923.

Description of crops	Agricultural years								Average	
	1919-1920		1920-1921		1921-1922		1922-1923		1919-1923	
	ha	%	ha	%	ha	%	ha	%	ha	%
Beans alone	61 783	0.71	81 869	0.82	68 563	0.66	68 065	0.64	70 070	0.71
Beans and Maize (1)	239 485	—	309 912	—	563 208	—	600 944	—	428 387	—
Peas	10 395	0.12	11 941	0.11	11 199	0.11	11 669	0.10	11 076	0.11
Lentils	3 285	0.04	4 592	0.04	12 709	0.12	8 346	0.07	7 233	0.08
Broad Beans	2 571	0.03	7 812	0.08	1 314	0.02	1 649	0.01	3 411	0.03
Lucerne	28 121	0.33	54 827	0.55	80 491	0.77	85 128	0.80	62 146	0.61
Clover	31 002	0.36	79 423	0,79	93 285	0.92	99 132	0.93	75 710	0.71
Total	137 157	1.59	239 564	2.39	367 561	2.60	274 289	2.55	229 646	2.28

(1) The data relating to areas planted with beans and maize are not included in the totals.

Table I shows that except in the case of broad beans, lentils and beans, the area under the other leguminous crops increased progressively from 1919 to 1924.

The total areas under leguminous crops continually increase between 1919 and 1923, while the percentage of areas also constantly increase, except in the year 1922-1923, when they show a decrease. Finally, the average percentage leguminous crops sown annually again indicates that the cultivation of these crops is insufficient if we consider their importance from the point of view of rotation, agricultural statistics and soil fertilisation, human and livestock consumption, etc.

Except beans, which have long been grown and the pods and seeds of which form one of the principal foods of the rural population, the others have attained agricultural importance only in our own time, and their more extensive cultivation forms one of the agricultural problems of the future.

The extension of the cultivation of peas, which constitute a substantial cattle feed and are in great demand for export, will enable us to improve the defective system of sowing wheat after maize, and at the same time to maintain soil productivity and considerably increase the exportation of wheat.

As regards the cultivation of leguminous crops for fodder, the increase of this system is one of the fundamental conditions for the improvement of our breeds of cattle intended to supply the country's needs, and also for export requirements.

Leguminous crops, according to local characteristics and the degree of intensity and systems of cultivation, occupy areas of varied extent in the different provinces of the Kingdom, as may be seen from Table II (see page 683).

If the totals for the different provinces are examined it is seen that Transylvania holds the first place as regards extent of area under leguminous crops; then follow the Old Kingdom, Bucovina and Bessarabia. As regards the proportion of the total area cultivated, Bucovina takes the first place, followed by Transylvania, the Old Kingdom and Bessarabia.

Leaving out the areas under lucerne and clover, which are not dealt with in this report, as also the areas on which beans are grown with maize, the data shown in Table III are obtained (see page 683).

The figures in Table III show that the four chief crops are variously apportioned in the chief provinces.

TABLE II. — *Areas under leguminous crops in the year* 1922-1923.

Description of crop	Old Kingdom		Bessarabia		Bucovina		Transylvania		Roumania	
	Area ha	% of total crops	ha	%	ha	%	ha	%	ha	%
Beans alone. .	49 887	0.92	10 040	0.36	90	0.03	8 040	0.36	68 057	0.06
Beans among maize (1). .	408 725	—	2 069	—	13 640	—	176 510	—	600 944	—
Peas	7 103	0.13	1 424	0.05	519	0.19	2 623	0.11	11 669	0.10
Lentils	2 977	0.05	2 474	0.09	228	0.08	2 667	0.12	8 346	0.07
Broad Beans .	269	—	289	0.01	575	0.22	816	0.04	1 949	0.01
Lucerne . . .	26 474	0.50	1 657	0.06	1 590	0.58	55 407	2.47	85 128	0.80
Clover	3 896	0.07	367	0.01	19 780	7.28	75 089	3.35	99 132	0.93
Total . . .	90 606	1.67	16 251	0.58	22 782	8.38	144 642	6.45	274 281	2.55

(1) The figures for beans grown with maize are not included in the totals.

TABLE III. — *Areas under leguminous crops per province.*

Provinces	Beans		Peas		Lentils		Broad Beans		Total	
	ha.	%	ha.	%	ha.	%	ha.	%	ha.	%
Old Kingdom . . .	49 888	0.92	7 103	0.13	2 977	0.05	269	—	60 237	1.10
Bessarabia	10 040	0.36	1 424	0.05	2 474	0.09	289	0.01	14 227	0.51
Bucovina	90	0.03	519	0.19	228	0.08	575	0.22	1 412	0.52
Transylvania. . . .	8 047	0.36	2 623	0.11	2 667	0.12	816	0.04	14 153	0.63
Total . . .	68 065	0.64	11 669	0.10	8 346	0.07	1 949	0.01	90 029	0.82

Thus beans occupy a greater relative and absolute area in the Old Kingdom, next come Bessarabia, Transylvania and Bucovina. The Old Kingdom again holds the first place for total area under peas ; then follow Transylvania, Bessarabia and Bucovina, the maximum relative area (in proportion to its size) being in Bucovina.

Lentils are grown over larger areas in the Old Kingdom,then come Transylvania and Bessarabia, which has a proportionally larger percentage.

In all four provinces, beans occupy very limited areas ; the greatest area under beans is in Transylvania and the largest relative area in Bucovina.

Fig. 110 shows graphically the percentage of areas under leguminous crops as compared with the total area under cultivation in each province.

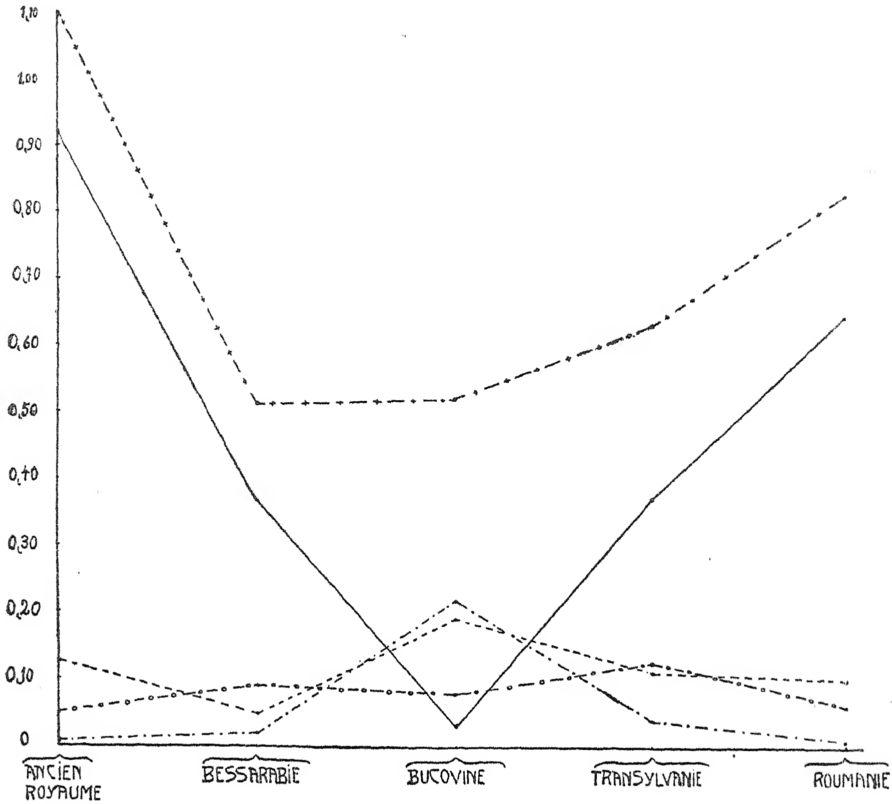


FIG 110. — Graph showing the percentage of areas occupied by leguminous seed crops out of the total area cultivated in each province.

- - - - - Beans — + — + — Total — o — o — Lentils
————— Peas — . — . — Broad beans

The figures in Table IV show that with the exception of Bucovina the greatest part of the total area in each province under leguminous crops is occupied by beans. Peas take the second place in the Old Kingdom, and lentils in Bessarabia and Transylvania. In Bucovina, owing to its milder and moister climate, broad beans take the first place, then come peas, lentils and beans.

As regards the data for each crop in the four provinces, beans hold the first place in the Old Kingdom, peas and broad beans in Bucovina and lentils in Transylvania.

These facts are better illustrated in Fig. 111.

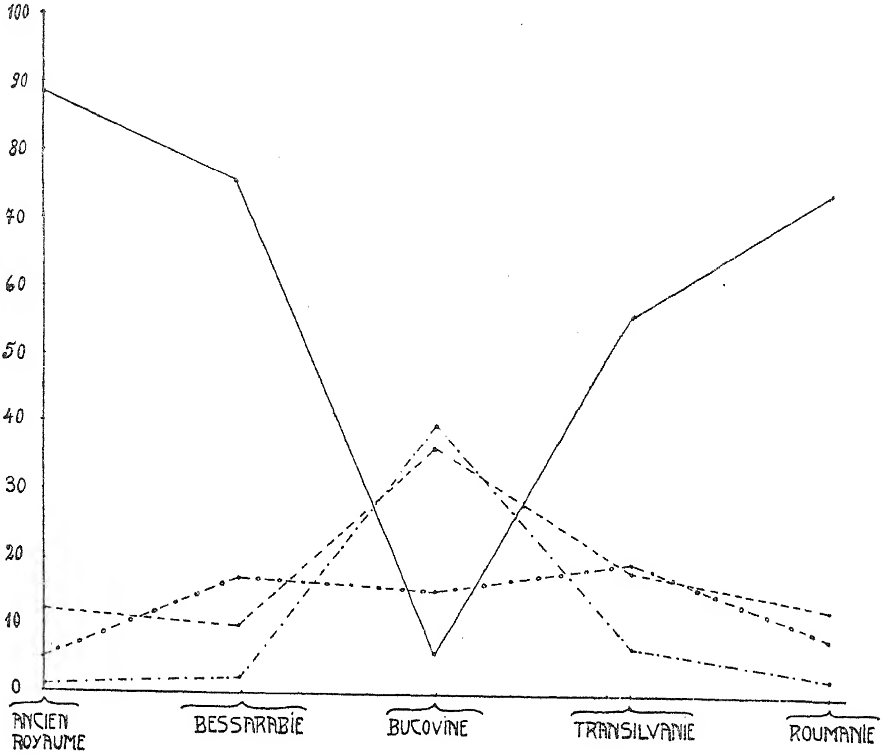


FIG. III. — Graph showing the percentage of areas occupied by leguminous seeds out of the total area under leguminous crops in each province.

- - - - — Beans　　　— o — o — Lentils
———— Peas　　　— . — . — Broad beans

TABLE IV. — *Percentage of areas, under each crop as compared with total area under leguminous seeds.*

Provinces	Percentages of areas under leguminous seeds				
	Beans	Peas	Lentils	Broad Beans	Total
Old Kingdom	82.82	11.79	4.94	0.45	100.00
Bessarabia	70.56	10.01	17.39	2.03	100.00
Bucovina	6.37	36.76	11.15	40.72	100.00
Transylvania	56.85	18.54	18.54	7.77	100.00
Roumania.	75.60	12.96	9.27	5.17	100.00

Yield of leguminous crops.

The absence of conformable systems of cultivation and of a scientific agricultural technique causes the agricultural output of the Country to oscillate from one year to another under the influence of the climatic factors on which the abundance of crop-yields always depends.

In the yield of leguminous crops the same phenomenon is noticed as in that of cereals.

The statistical data for the years 1920-1923 for the whole country (Table V) speak for themselves :

Table V. — *Total and average yield of leguminous crops in Roumania.*

Description of crop	1920-1921		1921-1922		1922-1923		1920-1923	
	Total hl	Hl per ha	Total hl	Hl per ha	Total hl	Hl per ha	Total hl	Hl per ha
Beans alone	503 539	6.1	521 231	7.6	835 056	12.3	619 942	8.6
Beans among maize	811 690	2.6	1 551 241	2.7	2 171 114	3.7	1 511 352	3.0
Peas	108 217	9.8	166 773	14.8	162 590	13.9	145 860	12.8
Lentils	27 765	6.0	118 146	9.3	96 511	11.6	80 807	8.9
Broad beans	54 688	7.0	19 534	14.8	22 625	11.6	32 282	11.1

The figures in Table V show the great variations in the average production of the four leguminous crops per ha. The average for the three years of the crop yield per ha. also show that the latter is low and much below the productive capacity of the soil and of our climatic conditions.

The variation in yield also depends on the provinces where the plants are grown. and to illustrate this point statistical data are given relating to production per province in 1922-1923 (TableVI) (see page 687).

These data show that during the agricultural year 1922-1923 the greatest yield of beans and peas per ha. was that of the Old Kingdom and Bessarabia, of lentils, that of Bucovina and the Old Kingdom, while Bucovina produces most broad beans. As regards

TABLE VI. — *Yield of leguminous crops in the Roumanian provinces in* 1922-1923.

Crops	Old Kingdom		Bessarabia		Bucovina		Transylvania		Roumania	
	Total hl	Hl per ha	Total hl	Hl per ha	Total hl	Hl per ha	Total hl	Hl per ha	Total hl	Hl per ha
Beans alone . .	663 055	23.3	100 273	9.9	882	9.8	70 846	8.8	835 056	12.3
Beans among Maize	1 608 946	3.9	19 911	9.6	35 713	2.6	506 544	2.8	2 171 114	3.7
Peas.	105 472	14.8	21 207	14.9	5 501	10.6	30 410	11.6	162 590	13.9
Lentils.	35 119	15.2	34 090	13.8	3 436	15.1	13 866	5.2	96 511	11.6
Broad beans . .	3 321	12.4	3 598	12.5	7 517	13.1	8 199	10.1	22 625	11.6

production for export, beans take the first place, then come peas and lentils, and last, in comparatively very small quantities, broad beans.

The general conditions have been described bearing on the importance of leguminous crops in our agriculture: we will now show how each of them is cultivated and the principal varieties most largely grown.

BEANS.

These form, together with maize, the alimentary basis of our rural population, whose food is essentially composed of leguminous plants.

The majority of the population eat only ripe beans (without the pods) made into soup or purée, on all fast-days, which are strictly observed by people of all ages. In spring and at the beginning of summer, this part of the population also consumes the green bean-pods as a salad.

As regards the town population also, beans, either the green pod or the dried bean, form a food of first-class importance. The urban population also shows great preference for preserved beans, which has given rise to a great and very prosperous industry.

In view of the important part played by the bean, especially as a food for the rural population, it is mostly cultivated by the small growers, first for household needs and then for the market.

The large farmers who grow beans for the market or to ensure a well-balanced rotation, do so almost always in co-operation with the peasants, allowing them a proportion agreed upon in advance, owing to the difficulties of cultivation and the work of upkeep which hey necessitate.

Beans are almost always sown after straw cereals, without any special attention being given to the soil. On the small farms, which now comprise, after the agricultural reform, 90 % of the arable soil of the country, the cultivation of beans keeps parallel with that of maize. They are grown either alone, on odd pieces of land, on the borders of maize or potato plots, or among maize, the vine, or other crops. The large farmers grow them in the same way. The greater part of the annual production, 90 %, is sown between maize, as may be seen from the averages for the years 1920-1923. On soils planted with beans, autumn wheat, and sometimes only spring cereals, are sown. Many varieties are grown in Roumania, differing in the form, size and colour of the bean, and these have not yet been studied. The chief of the usual varieties are :

(*a*) *The " common " bean*, white, long, slightly curved, belonging to the *Phaseolus vulgaris* variety, with a climbing or straight stem; it is more frequently grown among maize, which serves as a support, or on sticks ; it is fairly productive. The pod averages 9 cm. long ; the weight of 1000 beans is 330-450 gm. The yield is 900-3000 kg. per ha., and the weight of the hectolitre 72-80 kg.

(*b*) *The " gogoneata " bean*, belonging to the *Phaseolus sphaericus* variety, is a dwarf bean and non-climber ; the colour is white, round, of average size, productive and rather widely grown. There are also climbing varieties.

(*c*) *The " ousvara " bean* (*Phaseolus sphaericus*) also called the " little mountain egg ", resembles the preceding variety ; the bean is white, but smaller ; it is mostly grown in Moldavia.

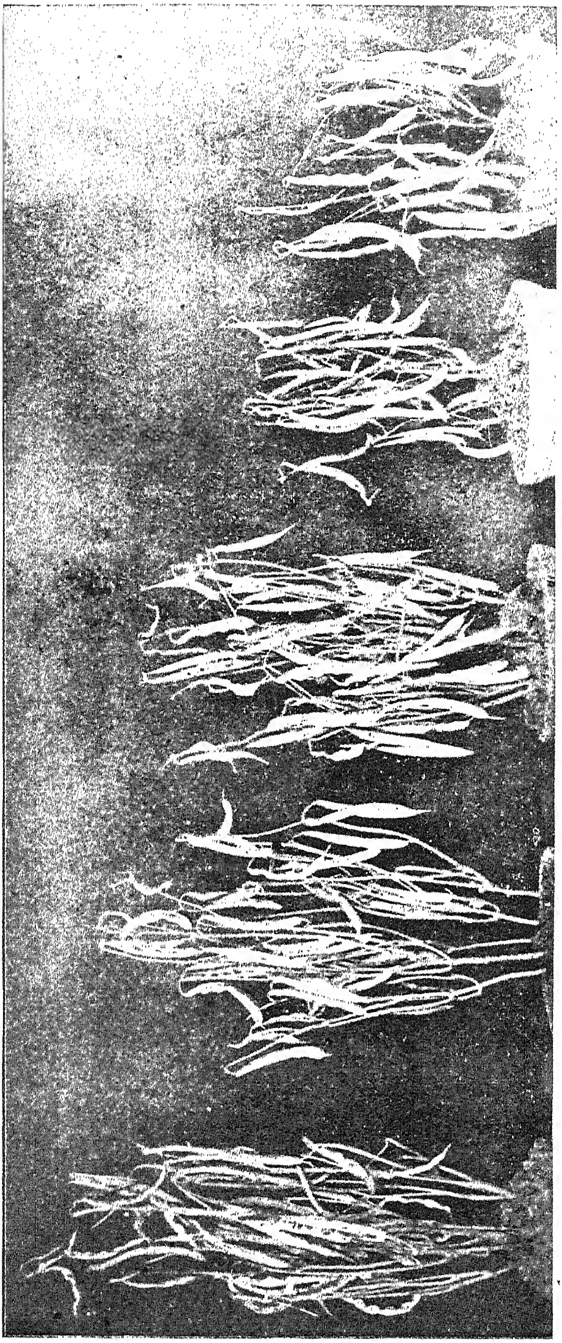
(*d*) *The " copacica " bean* (*Phaseolus sphaericus*) is of average size, round and white. The pod is long and slightly curved towards the end. It is a productive and widely grown variety.

In Plate LIII, No. 3, this variety may be seen with fully matured pods, and in Plate LIV, No. 5, the size and shape of a pod is shown.

(*e*) *The " obadata " or " latareata " bean* (*Phaseolus compressus*) is a climber trained, on sticks. It is less common. The bean is long, slightly curved like a kidney and white. The pod has an average length of 9 cm., the weight of 1000 beans is 330-450 gm., and the weight of a hectolitre is 72.8 kg. Plate LIII, No. 2, shows this variety fully matured, with pods. In Plate LIV, No. 1, may be seen the shape and size of the pods and in Plate LVI, No. 11, the shape of the bean.

(*f*) *The " flageolet " bean* (*Phaseolus oblongus*) is a foreign variety, with coloured beans. The chief kinds are : the red, yellow,

PLATE LIII.



1 = Krupbohne; 2 = Obadata; 3 = Copacica; 4 = Alba mica; 5 = Kaiser Wilhelm.

FIG. 112. — Size of some varieties of beans. (After C. ROMAN and J. ENESCU).

PLATE LIV.

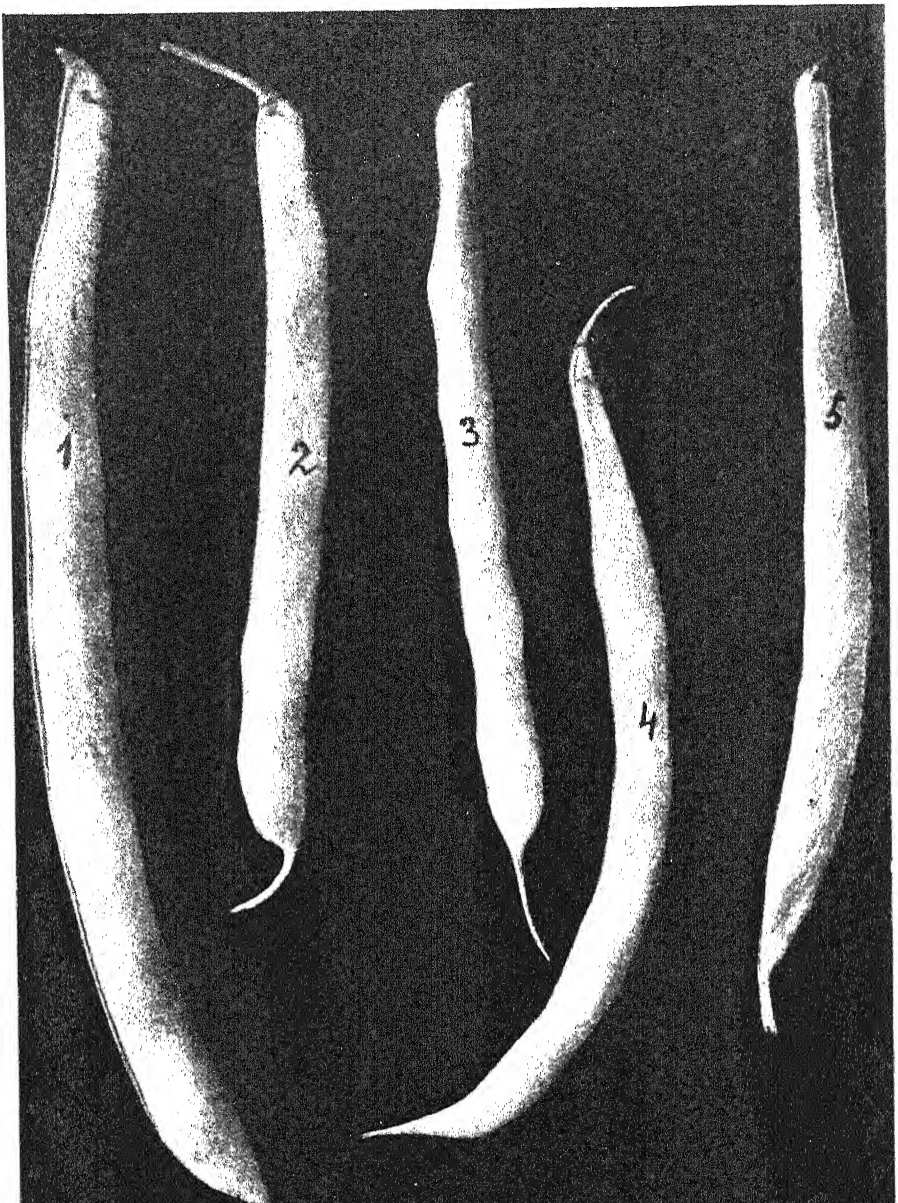


FIG. 113. — Some pods of the chief varieties of beans (natural size, after C. ROMAN and J. ENESCU).

1 = Obadata ; 2 = Kleine weisse ; 3 = Allerfrüheste ; 4 = Pariser Eier ; 5 = Copacica.

PLATE LV.

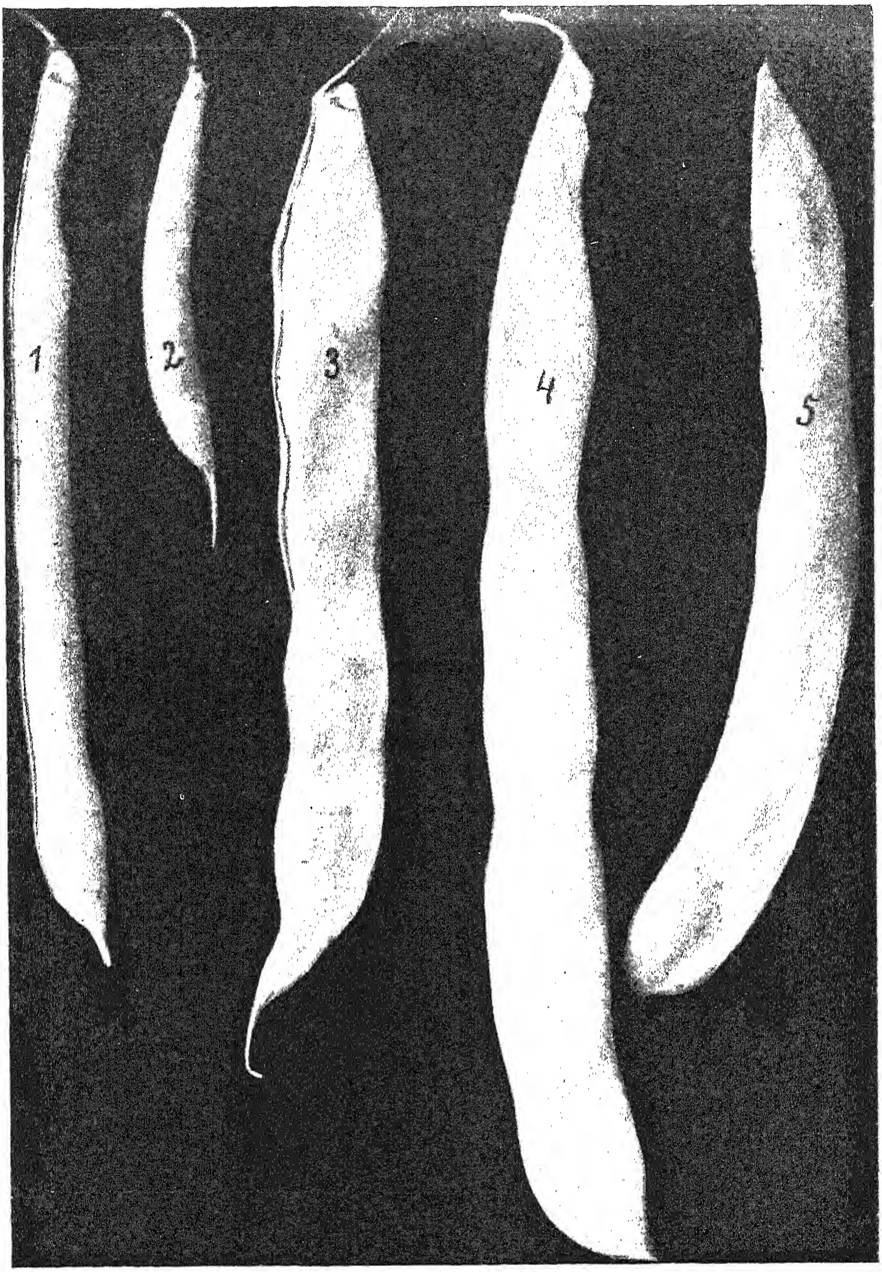


FIG. 114. — Some pods of the chief varieties of beans (natural size, after C. ROMAN and J. ENESCU).

1 = Flageolet vert; 2 = Zuckerperl; 3 = Kaiser Wilhelm; 4 = Schlachtschwert; 5 =

PLATE LVI.

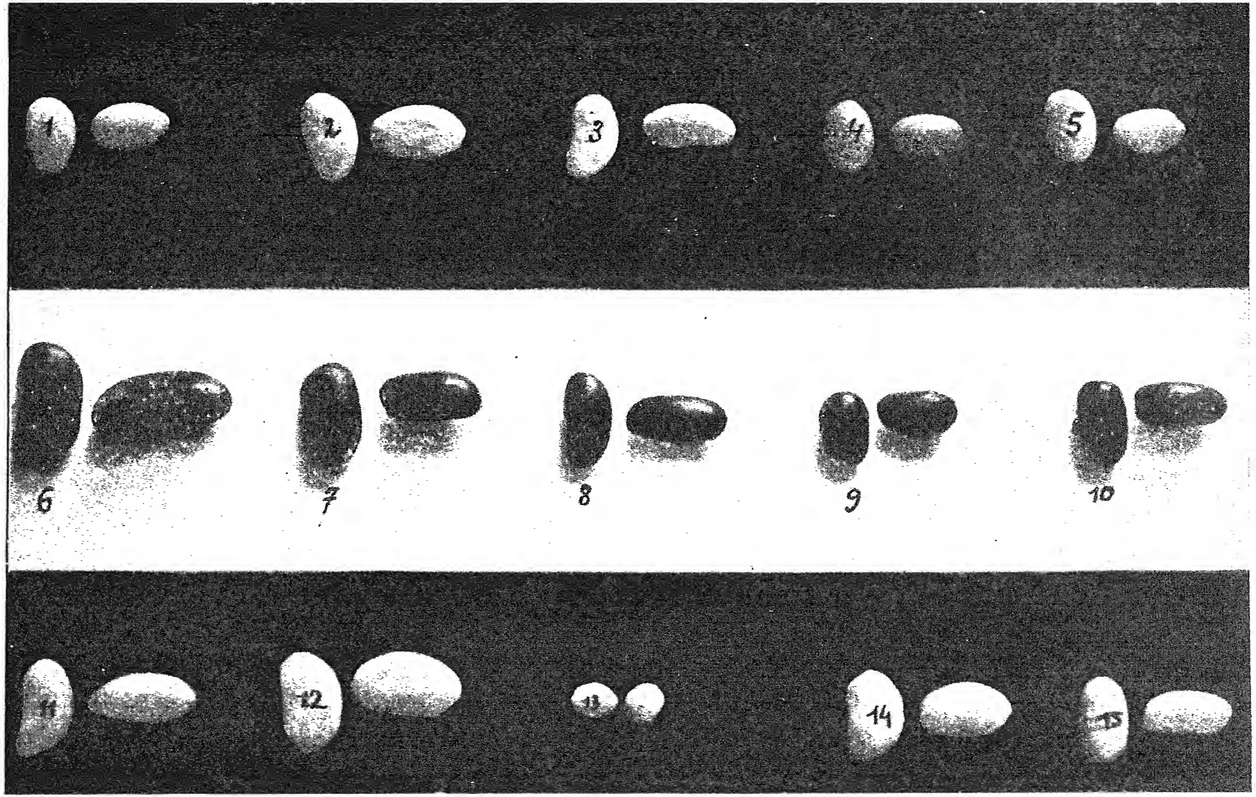


FIG. 115. — Seeds of varieties of beans (natural size, after C. ROMAN and J. ENESCU).

1 = Kleine weisse; 2 = Kaiser Wilhelm; 3 = Allerfrüheste; 4 = Pariser Eier, gelbe; 5 = Remontant; 6 = Flageolet rouge; 7 = Flageolet jaune; 8 = Non plus ultra; 9 = Mont d'or; 10 = Americana; 11 = Obadata; 12) Schlachtschwert; 13 = Margele; 14 = Grosse weisse; 15 = Flageolet grünbl.

and greenish-white. The last named is most common. The pod is very long and fleshy and can be easily preserved for winter use, In Plate LV, No. 1, is seen the shape of a "flageolet vert" pod. Here. it is well to recall the "tucara zuckerbohne" variety, little grown but highly appreciated for its pods, which may be consumed raw or preserved.

At the Agricultural Station at Bucharest trials have been made for several years with foreign and native varieties of beans.

Table VII shows part of the experimental data collected during 1912 regarding the chief qualities of the varieties grown :

TABLE VII. — *Experimental data concerning the chief qualities of the varieties of beans grown.*

Name of varieties	Length of pod in cm.	Weight of 100 beans in gms.	Weight of a hl. in Kg.	Yield per ha in Kg.	%	Mineral content %	Nitrogenous matter %
1. Copacica	7.4	300	79.8	2 100	13.00	3.72	21.38
2. Obadata.	9.4	330	76.4	1 230	14.00	4.00	20.53
3. Kleine weisse . .	6.6	292	75.2	900	14.00	4.10	23.44
4. Grosse weisse . .	10.12	305	74.0	1 312	12.40	4.20	24.42
5. Schlachtschwert .	11.8	318	73.8	764	13.35	4.20	23.08
6. Kaiser Wilhelm .	11.1	307	73.8	1 062	13.95	3.94	21.26
7. Allerfrüheste . .	9.4	249	76.0	856	12.95	3.97	22.96
8. Flageolet vert . .	8.0	140	75.8	906	16.05	4.00	22.84
9. Nain mange-tout.	7.1	262	76.0	1 062	12.95	4.36	23.81
10. Pariser Eier . . .	6.8	300	79.7	669	15.00	3.52	22.84
11. De Soissons . . .	8.6	299	77.0	1 450	13.15	4.48	21.38
12. Suisse blanc. . .	10.0	385	77.0	1 562	13.10	4.29	22 59
13. Kruppbohne. . .	9.2	331	77.5	794	13.00	3.30	23.62
14. Stammbohne. . .	7.9	316	78.0	1 000	—	—	—
15. Heinrich Riesen .	5.5	255	78.4	344	12.60	4.05	23.57
16. Zuckerperl. . . .	5.3	140	79.0	481	—	—	—
17. Américaine. . . .	7.2	305	78.	1 015	—	—	—
18. Mont d'or. . . .	6.9	225	78.8	781	—	—	—
19. Non plus ultra .	8.7	296	76.0	1 069	—	—	—
20. Flageolet rouge .	14.1	262	72.0	1 203	—	—	—

It will be seen that the local varieties "copacica" and "obadata' yield the highest production per ha., the hectolitre weighs heavy, and they are among the foremost as regards percentage of nitrogen. Among the foreign varieties, the most remarkable for production are the "Suisse blanc", "de Soissons", "Grosse weisse", Flageolet rouge" "Non plus ultra" and "Nain mange-tout".

Cultivation of beans. — For sowing, the soil is ploughed deeply in autumn and more superficially in spring. The small growers however only plough the soil once in spring, but with our soils and climatic conditions the crop yield suffers thereby.

Sowing takes place at the end of April or beginning of May, according to the district, the soil then being warm and the late frosts no longer to be feared. If the beans are not sown among other crops, the machine drill is used, which sows them in rows 30-50 cm. apart. By this system 80-100 kg. of seed per ha. is required. In small farming however the beans are sown in hills, forming regular rows. In this case the sower makes holes about 20-30 cm. apart and a boy drops 4-5 seeds in each hole and covers them over with earth. The rows thus formed are 30-50 cm. apart. In this way less seed per ha. is used.

In small farming, beans are always grown among maize. They are sown in a line made before the passage of the plough, which opens the furrow in which the maize is afterwards sown, so that the rows of beans alternate with those of maize. In this way the ridge formed by the plough covers the bean seeds.

The maize is dibbled in lines, in holes, or broadcasted : in each of these cases the beans may be sown in holes.

The upkeep of the fields includes hoeing and ridging up. The first hoeing is done when the plants have a few leaves care being taken to weed well. The second hoeing is done when the plants are near the flowering period. When the beans are sown in hills they are also ridged up at the time of the second hoeing, though this is injurious in arid regions, and is also very costly.

The growth period lasts from 90-120 days, according to districts and varieties. The pods are gathered gradually during growth if they are intended for consumption in a green state, otherwise at full maturity, which they generally reach in August.

When the pods begin to turn yellow and the beans are nearly hard, the plants are pulled up by the roots, placed in heaps and allowed to dry for 4-5 days. The beans are afterwards separated with a flail or threshing-machine ; horses are also used.

Among the most widespread diseases and pests of these plants, among which they do great damage, may be mentioned *Uromyces Phaseoli* and *Melolontha vulgaris*.

PEAS.

Contrary to beans, peas are much less grown as a field crop properly so-called, as is shown by the statistical data at the commencement of this article. The areas under peas belong almost exclusively to large farms where they are included in the crop rotation in order to improve the soil for wheat, or where the peas are intended for the market, or with the stems form a good livestock feed, especially for sheep.

They are not much used as a food by the population except in the towns, where the peas and pods are eaten green or preserved. The town population also consumes the ripe peas, as purée, seasoned with linseed oil. The rural population do not care for these peas, on account of the *Bruchus Pisi* larvae, which attack the peas.

It is noteworthy that during the war entire regiments refused this food, even when prepared with butter or lard or the addition of meat, and only took the daily ration of bread. It was only shortly before the war and in exchange for various benefits, that the agricultural co-operatives through their agronomists succeeded in getting the small peasant farmers to cultivate this plant.

The varieties grow are :

The "Victoria" pea, which is vigorous and very productive, has long straight pods ; the peas themselves are large, round and yellowish white. The growth period is about 3 ½ months ; the plant reaches maturity before wheat.

The "Folger" pea grows less vigorously than the foregoing and its growth period is shorter, it being on this account more esteemed by the growers. The pea is smaller, round and greenish.

Besids these two varieties mention should be made of the sweet pea, different kinds of which are grown in the large kitchen gardens, or on the field properly so-called, for their pods, which are consumed green or preserved.

The greater part of the field pea crop properly so-called is exported.

Pea cultivation. — Peas are generally planted after cereals and before wheat, the nature of the soil not being taken much into account. They are sown in Spring as soon as the snow has melted

and the soil has been warmed a little, generally in March, in soils which have been deeply ploughed the previous Autumn. In sowing the seed is scattered over the ploughed soil, over which an iron-toothed harrow is then passed to cover the seed. By this system, 160-200 kg. of seed per ha. are needed. Sowing may also be done in regular lines with a machine drill in well ploughed soil over which the harrow has already been passed. In this case 140-170 kg. of seed per ha. are needed, and a distance of 20-30 cm. is left between the lines. After sowing, the soil is harrowed or rolled according to its condition. No upkeep is necessary.

Harvesting is done in July, when the first pods are mature. The plants are mown or pulled up by the roots, placed in small heaps to dry, then in larger heaps, and when they are quite dry, threshed with a machine or by horse-power.

The cryptogamic diseases which cause most damage are *Uromyces Pisi* and *Peronospora Viciae*. The most prevalent insect pests are *Bruchus Pisi, Namestra Pisi, Aphis Viciae Plusia gamma*, etc,

LENTILS.

Though they do not occupy a very extensive area, lentils are rather largely grown. The areas under lentils, as shown by the statistical data, are owned almost exclusively by the small peasant farmers.

Lentils in the form of soup are consumed both by the rural and urban populations, also as purée, or prepared with meat. They succeed in all soils and all our agricultural districts suit them,

There are two chief varieties, differing in size and colour: (*a*) large, flat and greyish-yellow; (*b*) small, flat and greyish-green or reddish-grey.

Like beans, lentils are grown by the small farmers on small odd strips of soil at the side of those crops which precede wheat. The preparation of the soil is the same as for beans and peas. They are sown in April and May at the same time as beans, by hand, 120-140 kg. per ha. for the small variety and 150-180 kg. for the large.

During growth they are regularly weeded, and at harvest are pulled up, well dried and threshed by horses or with a flail.

BROAD BEANS.

They are much less common than the other legumes. The two chief varieties are grown on very limited areas. The large (*Vicia Faba*

major) has been grown the longer, and only in kitchen gardens, for the pods and beans, which, in a green state, form part of the food of the urban population.

The small variety (*Vicia Faba minor*), though very important as a cattle feed, is grown over small areas by the large farmers and on the Government farms.

The place occupied by the broad bean in crop rotation and the way in which it is cultivated, are the same as for the bean.

CHICK PEAS, LUPINS, AND SOYA.

Chick peas are also cultivated over small areas, mostly in the warmer regions, such as Bessarabia for instance. The most common variety is of medium size, like peas, round and yellow. The urban population, especially the Greeks and Armenians, eat them dried. Their cultivation is similar to that of beans.

In addition to the plants already enumerated, the *lupin* should also be mentioned. In spite of its importance as a cattle feed, it is grown very little. The best known varieties are: *Lupinus albus*, *L. luteus*, *L. angustifolius* and *L. polyphyllus*.

None of these have become naturalised in cultivation.

Twenty years ago extensive propaganda was carried on in favour of different varieties of *soya* (Chinese pea); all the varieties introduced into Roumania however remained on the experimental field: none succeeded in holding its place or even passing into field cultivation.

Dr. M. CHIRITESCU-ARVA,
Professor of the Academy of Agriculture, Cluj.

BIBLIOGRAPHY

(1) MINISTÈRE DE L'AGRICULTURE, *Bulletin de l'Agriculture*.
(2) Prof. Dr. G. MAIOR, Culture spéciale des plantes. Bucharest, 1898.
(3) M. POPOVICI and G. CIPAIANU, *Manuel d'Agriculture*, Bucharest, 1922.
(4) Prof. Dr. G. JONESCU-SISESTI. Les champs d'expériences de Spantzov. Bucharest 1911, 1912, 1913.
(5) Prof. Dr. N. O. POPOVICI-LUPA. *L'Agriculture*. Bucharest 1914.
(6) C. ROMAN and J. ENESCU. Expériences avec des variétés de plantes à la Station agronomique pendant les années 1912 et 1913.

STATE IRRIGATION, AND AGRICULTURE IN THE SOUTH OF ITALY.

Extension of Irrigation in Italy.

The problem of the greater extension of Italian irrigation is now engaging the undivided attention of technical experts and students and is perhaps the most important of the many means by which it is sought to obtain the greatest increase in agricultural production as a means of subsistence for the 40 millions of Italians inhabiting an area of scarcely 300,000 sq. km. and having only limited possibilities of emigration.

One of the most eloquent proofs of this tendency was the meetings held at Milan, the first, on public waters, last October, and the second, on irrigation, in April, on the most important questions regarding technical matters and hydraulic legislation. A further meeting will probably be held at Naples next autumn at which the same subjects will be examined from the point of view of the requirements of the Southern and Insular regions.

As is known, the prosperity of one of the most characteristic forms of Italian agriculture, that of the zone on the left bank of the Po, is due to the irrigation carried on there by methods from which it may be said every country in the world has drawn instruction. Its traditions go back to the dawn of time, and, not to speak of the Etruscans who are said to have been the first who dammed the course of the Po, it is an undoubted fact that at the time of the Romans there were canals and irrigation. Among other historic allusions, is that of the well known line in the Georgics of Virgil:

Claudite jam rivos pueri — sat prata biberunt.

There are also canals in this region of the most remote antiquity, the origin of which has not yet been traced, but which can most probably be referred to the Roman period, when the Paduan Valley had attained a very high degree of economic prosperity.

Here the utilisation of the waters found a most favourable application in a combination of natural sources of supply with the most admirable devices of human art. First there were the ample stretches of perpetual ice and snow in the Alps, which, when they melt, form a valuable supply of water in the summer season, whence the large rivers of those regions enter one of their periods of flood in May or June. The great lakes at the foot of the principal range then act as reservoirs to hold the waters when they are at their highest.

Legislation helped to improve these favourable conditions, facilitating the construction of canals, even those of the smallest capacity, by permitting the occupation of the territories traversed by them, and by means of the well known constitution of the temporary subjection of the waters (*service of coactive acqueducts*) of which there were still traces in the early centuries of the Middle Ages. The Proprietors' Unions then soon sprang up, which by co-operation rendered the benefits of irrigation less costly, while from the XII and XIII centuries the communes and local domains constructed great canals which still arouse the wonder of engineers and to which the Unions themselves could thus connect their smaller tributary waterways. All this activity was still further aided by the constitution of the absolute freedom of possession of landed estates, which was early freed from feudal bonds and regulated by the principles of Roman jurisprudence, whereby for the first time perhaps in the economic history of the world was formed an industrial agriculture with business connections between the capitalist and salaried contractor, as it continues to exist at the present day. This was a great advantage for that region, the soils of which, without the aid of the water, would only give a low yield because most of them are not very fertile owing to the prevalence of silica.

Work on a large scale however in Lombardy and Piedmont came to a standstill for a long period during the foreign dominations after the XV century, and was only resumed on the constitution of the State of Italy. Already in 1859 little Piedmont was begining the construction of the Cavour Canal, when it declared war on Austria, and the new Government also encouraged a number of other works which transformed vast tracts in the subalpine regions. To form an idea of only a part of the activity in this field it will suffice to recall that the Cavour Canal, with the others forming part of the same system, had already in 1908, in the region bounded by the Po and Ticino, 454 km. of principal sectors, 285 of branches and

754 of secondary waterways, besides an infinity of minor networks. The canal has a capacity of about 200 c. metres of water per second and supplies water to perhaps more than 200,000 hectares of soil.

An equally important work was carried out by private means aided by large Government subsidies, provided by special legislation in 1873, modified in 1886 and 1915 and in subsequent years and united in one code in 1923. By it the State undertakes to subsidise irrigation works, including the smallest, down to 1 litre per second, with annuities of 3 % of the cost for the first 10 years and 2 % for a further 10 or 20 years according to the extent of the irrigations, and 1 % for a third decade.

The Italian Government and Irrigation.

A special Department at the Ministry of National Economy supervises the distribution of the subsidies and as far as possible makes enquiries and researches and encourages the work in various ways. A most important part of its work in the past was the compilation of the hydrographic chart of Italy, in which, on a scale of 1 to 100,000, are marked the irrigated and irrigable territories, natural and artificial water courses with their measures of capacity, where ascertained, projects for artificial basins and much other useful information. The chart itself is accompanied by valuable monographs illustrating the hydraulic and irrigation systems of each province, showing the modifications in the system, projects for its extension, and all other matters relating to the water supply. This most important work, in spite of the paucity of means with which it was carried out, might still serve, after slight modifications, of brought up to date and with the aid of a sectional geometric survey, now completed for a great part of the Kingdom, to show the present topographical state of the Italian irrigation system.

The Ministry of Public works is making a series of most useful investigations through a Hydrographic Department whose special duty is to examine the basins of all the water courses. This was already completed before the war for fully a third of the Country and the "Magistrato delle Acque del Veneto", to whom is confided the care of the water supply for the whole of that district, gave effective assistance. Great activity was shown in the formation of rainfall estimation stations, which in the peninsular and insu-

lar zone a few years ago barely numbered 371, while in 1919 they had already risen to 1071.

The legislation on irrigation was afterwards completed by that on public waters, first by the law of 1884 and then by the decrees of 1916 and 1919. The decree of 1919 radically modified the preceding one, for it ratified the principle that all the water supplies from public sources should only be temporary and subject to annual control, even if possessed from time immemorial. Thus concessions are limited to a period of 60-70 years for the larger ones by motor power used for irrigation and of 30 for the other smaller ones, after which period the State might not renew them and might take over wholly or in part the installations and appurtenances according to the circumstance of the case. Many objections however have been raised against this legislation and in the meetings held it was strongly opposed, a resolution being passed in favour of its radical modification.

Irrigation in the South of Italy.

There are many aspects to the problem of irrigation in Italy owing to the great differences between the various localities, and more especially between the great Paduan Valley, the Peninsular part along the Appennines, and the Islands. In the Appennine range there are no high mountains with perpetual snow and ice to ensure a copious supply of water in the summer season, also between its watershed and the sea there are, especially on the Adriatic side and still more so in the Calabrian region and the Islands, very short slopes, sometimes measuring only a few kilometres. Hence the water courses are very numerous, but most of them have limited basins and, especially, a torrential system, whereby they contain abundant supplies of water, sometimes to an injurious extent, in winter, and very little or none at all in the summer, when there is the greatest need of it for irrigation. With the exception of a few canals of small capacity in Tuscany, Umbria and the Campania, in the whole of the remaining territory under examination there are only very small networks, and the subsoil furnishes one of the most frequent sources of water supply.

In this region on the other hand irrigation water is of the greatest advantage, even when the consumption is infinitely less than that in the North. In the Southern provinces indeed 300 cu. me-

tres of water per hectare can suffice for garden and other green crops, and sometimes there are cases of a much smaller consumption, whereas in the Paduan Valley not less than 500 are given. In Sicily and Calabria with a constant supply of 1 litre per second, 3-4 hectares of citrus fruits are kept in condition, and about 3 of garden crops, whereas in Lombardy such quantity is barely sufficient for 1 hectare of meadow and 30-30 ares of rice. The fact is that, whereas in the North irrigation water is at most a means for increasing crop production, possible even without irrigation, so that it must be applied with a certain liberality, in the extreme South and in the Islands it renders certain crops possible which otherwise could not live. Moreover there is no crop there which does not derive the greatest benefit from even a modest supply ot water, from wheat to the vine itself, especially where it is necessary to make up for the serious lack of summer precipitations, which sometimes endangers the yields of woody crops.

A great part ot the Southern and Insular regions indeed during this period has only 50-100 mm. on an average, and not infrequently there are years in which from the beginning of April until November scarcely a drop ot rain falls. Where however there are no woody crops, after the grain harvest no others are possible, nor throughout the year are any possible except those sown in Autumn. In such conditions therefore, if small quantities of water are available, say from 2-3000 cu. metres, i. e. scarcely 0.25-0.35 litres per second for a period of 3 months, this is sufficient to return a good yield from so rich a soil, which during the whole of that period would have remained unproductive. And then the hot Southern sun, so trying if accompanied by drought, becomes on account of its intensity so much more effective for production.

For this reason the yield of irrigated soils in the South is, all other conditions being equal, superior to that of the same in the North, for in addition to the action of the water in the warm season there are added the effects of the mild climate of the previous winter. In any case the economic effects of irrigation are most convincingly shown by the recent figures relating to agricultural produce returns.

Last year a general revision of these figures was made, and they were quoted for the whole Kingdom in gold lire, as was the case for the land on 1st January 1914. The returns relating to gardens and citrus crops have shown from their exceptionally high figures

how the yield of the soil benefited from irrigation water. The first for instance, at Milan, reached a possible maximum of 600 lire per hectare for that commune, and in the province and generally throughout Lombardy they are not above 450, whereas in the neighbourhood of Naples garden crops rise to 1000 lire and in the province 800-900 are frequent, while at Palermo they are 950. In the same districts, where the best dry soil does not give returns of above 80-100, irrigated soil easily attained 250, 300 and even 400. The figures for citrus fruits are even more characteristic: those for the best in the provinces of Naples, Caserta, Reggio di Calabria, Catania, Syracusa and others, attained maxima of 1400 and even 1500. Returns of 1000-1300 are frequent, and no first class citrous areas, even in the least favourable conditions, were at less than 800, always of course in gold currency. Only water renders possible such miracles of production in which these high profits are possible.

Irrigation work in the South of Italy.

In the majority of cases the water comes from small springs, mostly drawn up from the subsoil and very rarely from canals with a constant supply in the summer season, for the reasons already given. The pumping up of water is mostly practised in districts far from the coast, and in the past it was almost solely done by animal power on the pulley system, the apparatus being sometimes of very rough construction giving necessarily very limited results. Today however the number of installations worked by mechanical and electric motors is continually on the increase, and in some coastal zones, as for instance in the Province of Lecce and in Sicily, wind-motor installations are also working.

Moreover the methods by which in some provinces water is sought and drawn from the soil are surprising. Of these one of the most characteristic is that of the *filter galleries*, so numerous and continually on the increase in the Province of Messina, and some examples of which are also to be found in that of Palermo. They are works constructed under the beds of the numerous short local torrents to hold up and collect the subterranean waters which flow down into them. The torrents themselves flow through channels which they have worn in formations which are mostly granite and schist, sometimes calcareous, and which have then become filled

with pebbles and gravel, among which the waters disperse to the sea. These deposits are then banked up with subterranean dykes, which do not emerge on the surface, but which hold back the water. Then, at the base of the dyke, is constructed a gallery furnished with pipes which draw off the water, and these, through a canal which connects with the gallery, are conducted to irrigate the land lying below, sometimes also supplying motive power.

An investigation made by Prof. GUIDO INFERRERA (1) in 1907 gave a list of about twenty such works and of 10 others in course of construction, besides several requests for water supply. Some of the first-mentioned dated back to the XVI century, and these generally had a minimum capacity, in some cases even 5-6 litres a second, and very few approached 100: many had galleries at a depth of 20-30 metres below the bed of the stream, some even at greater depths. Thenceforward their number has been increasing considerably.

The above mentioned works cannot therefore supply water except at a very high cost, so that even before the war they gave 1 cu. metre at not less than 18-20 centesimi, and a citrus plantation requiring 2500-3000 cu. metres incurred an expense of as much as 600 lire a year, and now from 5-6 times as much. But at the same time soils of low fertility produced as much as 100-150 quintals of oranges and 150-200 thousand lemons, or a gross profit of 3, 4 and even 5 thousand per hectare in gold currency.

Not less important economic results are obtained from the cultivation of green crops or even the simple cultivation of field crops, from which, even with modest irrigation and suitable fertilisation, seven crops a year of lucerne, with 120, 130 and even 150 quintals of hay, have been obtained. This is the most convincing proof of HEUZE's saying that "*two of sun and two of water do not make four but eight*", and perhaps also sixteen in countries with a warm arid climate, where the agriculturist who carries out improvements can scarcely turn to any but woody crops and to the utilisation of the very small streams of water he succeeds in finding.

(1) GUIDO INFERRERA. *The Sources of Water Supply from under the Beds of Streams in the South.* (« Le derivazioni subalvee del Mezzogiorno »). Catania, Battiato, 1907. Page 58 and foll. The author however declares that he has examined only the chief subalvean sources, leaving aside the smaller ones with which are collected, even with short galleries, streams of waler to irrigate a few ares of citrus fruits or garden crops.

The ingenuity shown in the construction of the filter galleries is equalled by that, no less ingenious, of the so-called crown reservoirs in the Province of Piacenza. They consist of reserves formed by surrounding the base of a hill with banks of earth in a half-moon shape (hence their name) to collect the waters which flow from the higher land, or are conducted thither by small streams close by. They are very modest works which rarely have a capacity of more than 100,000 cu. metres, but which supply water at a very low cost and might be extended to many other districts.

Moreover, the construction of large artificial basins has also been one of the problems solved in the last 30 years, and the law of 1919 has encouraged it by setting aside for the purpose subsidies up to 8000 lire annually for 50 years for every million cu. metre collected. Several such works are already in use in various parts of Italy, such as Bragimone (Bologna) and Tirso in Sardinia, and some immense works are in course of construction, among which are the Sila lakes in Calabria and those of Cosenza and the reservoir of Upper Belice in the Province of Palermo. The great heights at which the waters are collected will enable hundreds of thousands of horse-power to be developed for use in agriculture and industry and the waters will then be used for irrigation. Moreover, plans for several others have been completed — the State has been waiting several decades for them — and when the works thus planned have been carried out, tens of thousands of hectares will have their present low yield much increased and fully assured.

But though such works have a brilliant future owing to the double advantage they will confer of motor power and irrigation, we consider that, for the present, preference should be given to the smaller schemes, because of more immediate advantage. When these are in extensive use, the farmers themselves will very probably request the Government to carry out the great projects in order to extend irrigation, the advantages of which will have been appreciated more fully and their application to agriculture will have been well learnt.

In the work now being carried out in the districts of the South the small canals, mostly of a few litres per second, are still in the majority: the unit of cost is much greater than for those of large and medium size in the Paduan Valley, but, on the other hand, the results are greatly superior and the scarcity of supply is sometimes compensated for by the increased number in which they are

found. And it is on account of the great returns they bring that they should be sought after and retained even by costly devices which elsewhere would result in a loss; such devices consist especially in underground investigations at considerable depths for taking advantage of the costly filter galleries already described.

The application of mechanical motors, which raise a cubic metre of water at a cost $^1/_4$ or $^1/_5$ less than by the use of animal power, has enabled very deep springs to be utilised, so that in Sicily for instance, there are installations which draw water from a depth of 30 to 50 metres, for the irrigation of garden crops and citrus fruits. The supply of electric power in the country therefore, may become one of the most effective means of agricultural improvement and increased production, especially where it is available at a very reduced cost through the agency of natural waterfalls, or water retained in artificial reservoirs.

Small irrigations.

All these problems relating to small irrigations, and still more those in the warm arid regions of Italy, were not taken into consideration until very late, by the legislation already referred to. That of 1866 indeed, which granted annual subsidies of 3, 2 and 1 % respectively, during the three decades succeeding the completion of the works, reduced these subsidies to $^2/_3$ of the above figure for supplies of less than 100 litres per second and only in exceptional cases granted them to those of less than 25. The Apennine region and more especially the South and the Islands, thus remained excluded from the benefit of the subsidies, in spite of the more unfavourable conditions existing for irrigation undertakings.

This was made clear only later: the writer was perhaps the first to take the question up in a report to the Congress of Italian Agriculturists at Cagliari in 1905, and spoke in favour of the same principles at the Royal Commission on Irrigation appointed in 1910, after the enquiry as to the conditions of the peasant farmers of the South and of Sicily, which enquiry drew special attention to the necessity of encouraging by every means the increase of agricultural production. In consequence of this, the subsequent laws extended the benefits of the larger subsidies to canals having a capacity of one litre per second, even increasing them for these small

schemes and allowing them to be converted into total grants to be paid in advance, or to serve as a loan guarantee.

Meanwhile, with or without State subsidies, energetic work is being carried on everywhere in the matter of seeking and utilising subterranean and artificial waters. Along the Apulian shore from Gargano to Bari, by means of the former, sterile sand dunes have been converted into gardens, and there also even brackish waters are utilised. Elsewhere, for instance in the small province of Campobasso, in a few territories, 10-12 Irrigation Associations have already been formed, in spite of the prediction that this kind of institution cannot become established in the Southern provinces.

It is still a question however of small schemes, the prevalence of which is also shown in notes for a work by Cav. ORONZO VALENTINI, of the Ministry of National Economy. He points out that in a single year 148 subsidies were granted, of which only one was for the large work of the "Vittoria del Piave" Canal (Treviso) for 33 000 hectares, and the remainder for a total area of 5838, or an average of 36 ha. each. Indeed, whereas in Piedmont, Lombardy and Veneto, there were in all 62 requests for 3994 ha. in addition to the aforesaid large one, i. e. an average of 68 ha., each. in the rest of Italy there were 85 for 1344 ha., or 15.81 ha. each.

The state of the Italian budget did not allow of setting aside more than 3 millions yearly for these subsidies, in which are also included those for substituting mechanical motive power for the installations for pumping up water already existing. Such a sum however is inadequate for the needs of the Country, where to-day is seen the exceptional activity already referred to in seeking and utilising every kind of water resource, and especially subterranean ones, the more so that the subsidies in question would soon be returned to the State in the form of an increased volume of taxes, direct and indirect. Nevertheless, up to 30th June 1923 the State has subsidised irrigation works costing over 41 million lire to the extent of about 40 % of the cost, and the 1923-24 budget granted about 3 millions to projects completed for more than 1000 hectares of soil. Many others for large and small irrigation works are now being examined, for which it may be estimated that in a year or two Italian finances will aid irrigation to the extent of 5 millions yearly for about 30 years. Through the application of the Royal Decree of 11 December 1921, which subsidises investigations for subterranean water for the purpose of irrigation, and for human

and animal drinking purposes, subsidies have been given to the amount of 50000 lire, and finally 25 boring apparatuses have been acquired and handed over to the care of the Travelling Chairs of Agriculture, who grant them for use by those who intend to make borings for subterranean water, and several such have been made, some to a depth of as much as 100-150 metres. The total area of irrigation work now being examined may be estimated at about 100000 hectares, the majority of which are investigations for subterranean water. Moreover the continual efforts being made all over the Country and especially in the Peninsular zones and in the Islands show the great influence of the diffusion of electric motor pumps in extending irrigation and the economic advantages attendant on their use, and how necessary it is to carry on special work in aid of this system (1).

CONCLUSION.

From what has been said it is evident that the Third Italy has been able in this field also to carry out her task with honour and to develop a programme of activity and work which disposes of the *dolce far niente* legend so unwarrantably and detrimentally attributed to her.

The efforts she is making and has also made in the past to overcome the natural difficulties created in a territory in great part hilly and mountainous, and too often infertile by a climate which is arid over fully half of its extent, show the nature of the energy which still animates the old Italian race and the truth of VITTORIO ALFIERI's maxim that " to the plant man Italy was always a propitious land. "

Prof. ORESTE BORDIGA,
Royal Higher School of Agriculture, Portici,

(1) I tender my sincere thanks to Cav. Valentini of the Hydrographic Department of the Italian Ministry of National Economy, who has furnished me with some of the data and much of the information contained in the present article.

INTERNATIONAL ASSOCIATIONS

PROCEEDINGS OF THE INTERNATIONAL SOCIETY OF SOIL SCIENCE

Papers.

METHODS OF MECHANICAL ANALYSIS OF SOILS.

Some years ago I received from a colleague in X. some soil samples with the results of the mechanical soil analysis. Table I shows the results of the investigations carried out at X., and at Groningen, of three samples of soil with the humus removed.

TABLE I.

Soil Sample No.		1120		1121		1122	
	Fraction	X	Gron.	X	Gron.	X	Gron.
%	I . . .	33.6	61.7	47.8	70.3	2.7	1.3
	II . . .	42.6	22.2	31.4	15.1	9.1	5.8
	III . .	20.3	10.1	17.5	10.3	32.9	12.5
	IV. . .	3.2	0.2	3.8	4.0	55.3	80.4
	$CaCO_3$.		5.8		0.3		0.0

I am convinced that results of the kind shown in this table will be the rule in the case of comparative analyses conducted in different laboratories.

The great differences arise mainly from the methods of preparation followed. It is hence a first essential to come to an agreement on the method of preparation of the soil samples for mechanical analysis.

The principal object of this article is to describe and to justify those methods of preparation which were finally adopted after a

number of analyses conducted in the writer's laboratory jointly by A. Dekker, M. Dekker and H. Osterveld.

The second part of the mechanical analyses of soils, namely the separation of the soil particles after the preparation of the samples, was always effected in the Atterberg decantation cylinders and the samples were separated into the four Atterberg fractions.

In conclusion I propose (under heading B) to add some observations in regard to the new sedimentation methods, as followed by Wiegner, Odén, Robinson, and Krauss.

A) THE ATTERBERG METHOD OF DECANTATION.

At the first meeting of the Committee for the study of Soil Mechanics and Physics in Berlin, on 31 October 1913, I referred to the important influence of the preparation of the soil sample on the results of mechanical analysis. On that occasion I recommended a method by agitation with subsequent decantation, of Fraction I with dilute ammoniacal water, and of Fractions II, III, and IV with water (1). These fractions are the four Atterberg fractions: the decantation is carried out in accordance with Atterberg's directions, in the Atterberg cylinders (2). This type and method of decantation, as also the division of the soil particles according to Atterberg into four fractions (2-20-200-2000 μ), was retained throughout the analyses now to be described.

As long as the soil contains calcium carbonate or humus or both, the employment of the method of agitation is hampered by difficulties of various kinds:

(*a*) the calcium carbonate and the humus are distributed by the agitation over the different fractions, and accordingly, to determine the content of the sample in mineral particles of different sizes, the calcium carbonate and the humus must be determined in each separate fraction and removed. It may be noted here that the determination of the humus by means of ignition of the fraction is misleading, as the Fractions I and II contain in the weathered silicates considerable quantities of hygroscopic moisture.

(*b*) Calcium carbonate and humus cement the mineral particles of the soil, and the aggregates thus formed are not fully separable by agitation so that the dilute ammoniacal water used in decantation of Fraction I cannot dissolve all the organic matter. The presence of these cementing constituents (calcium carbonate

and humus) is also to be detected in the fact that the decantation especially of Fraction I and also of II takes a long time.

(*c*) It is not unlikely that the quantities of calcium carbonate and humus still present exercise an influence on the flocculation of the mineral soil particles. In the case of the decantation by the ATTERBERG method this influence becomes in practice very small: in the processes followed by ODÉN, WIEGNER, KRAUSS and ROBINSON, small quantities of calcium carbonate and organic matter must modify the results not inconsiderably.

I have attempted to obviate these difficulties by substituting for the agitation method the English method (3), viz., treatment with HCl and decantation with NH_4OH. By the English method the soil sample is worked up with HCl. As this operation is laborious and also gives rise to errors of a subjective kind, I have proposed to stir the soil sample with cold HCl and indeed with 100 cc. 0.2 n. HCl excess of what is required for the solution of the calcium carbonate (4).

As early as 1921 I observed that the Fractions II and III in the case of soils rich in humus continue to retain humus. It proved later that treatment with cold dilute HCl does not even succeed in dissolving all the carbonates in solution, as is shown by the following figures:

TABLE II.

No. of Sample	Total $CaCO_3$	$CaCO_3$ in the fraction			
		I	II	III	IV
B 1459	9.26 %	6.84	2.41	0.01	0.00
Bb 17	12.57 %	10.47	1.68	0.42	0.00
Bb 29	11.12 %	8.50	2.30	0.32	0.00
Bb 74	4.06 %	1.74	2.09	0.23	0.00

The following procedure may be adopted to overcome these difficulties:

The organic matter is removed by boiling with H_2O_2 by the Robinson method (5), *while the carbonates are dissolved by boiling with a small excess of dilute HCl,* (100 *cc.* 0.2 *N. HCl excess*).

At the Rome Conference (May, 1924) some opinion adverse to this preparatory treatment was expressed, both during the official discussion of the subject and also in personal conversation. In

particular the employment of acids, especially of boiling acids, was deprecated. On this account I shall deal with the question of the preparation of the soil samples with boiling HCl in more detail.

Treatment of Soil samples with Hydrochloric Acid.

I submit the following five observations for the consideration of opponents of the HCl treatment.

1. *Comparison of the HCl treatment with the agitation method, in the case of clayey soils free from $CaCO_3$ and humus.* — All scientists, including those who intend to make use of the soil in the least altered form, prepare the samples to some extent before decantation. (The various methods are: crushing and rubbing down with rubber pestle, brush or the finger, with addition of a little water, simmering with water, etc.). In all these methods a fairly considerable subjective error is inherent: the more forcibly the sample is rubbed, and the longer it is stirred or boiled in water, the higher is the content in small particles (Fraction I, resp. Fraction I-II). The method by agitation (1) was in this respect undoubtedly a great step in advance, and various opponents of the HCl treatment have consequently adopted this method of preparation. I desire to call the attention of these objectors to the results of analysis of a sample 1458, which was completely free from $CaCO_3$ and organic matter, the single soil particles thus being cemented together not by calcium carbonate and humus, but only by gels of Al_2O_3-SiO_2-Fe_2O_3.

Table III.

Method of preparation	Percentage content in fraction			
	I	II	III	IV
a) Agitation (1)	53.8	28.2	17.8	0.2
b) modified English method (4)	54.0	28.7	16.9	0.4
c) as (*b*) but boiling with HCl	54.9	28.0	16.8	0.3
d) Boiling with H_2O, decantation with H_2O	27.5	37.9	34.4	0.2

The decantation of Fraction I took place in (*a*) with ammoniacal water immediately after the agitation: in the case of (*b*) and (*c*) also with ammoniacal water, but only after the HCl and the salts that had passed into solution had been removed by decantation with water (6). The differences between (*a*), (*b*), and (*c*), are

very slight. This becomes the more obvious, when methods (*a*), (*b*) and (*c*) are compared with (*d*). And as already remarked the results following on the (*d*) preparation are influenced to a large extent by the length of the boiling.

2. *The 'sandy' character of the sand fractions.* — It is of course a difficult matter to distinguish which of the methods (*a*), (*b*), (*c*) or (*d*) yield the true mechanical composition of the soil sample 1458. The simple fact that method (*c*) gives the highest content in Fraction I is no evidence for its correctness. Perhaps the following considerations may be of use in judging of the different kinds of preparation. Fractions III and IV are called the sand fractions, and it is therefore desirable that after decantation of the Fractions I and II a really sandy mass be left behind. This is the case with methods (*a*), (*b*) and (*c*). When method (*d*) was followed, however, the fractions III and IV, viz. 34.4 + 0.2 = 34.6 per cent., formed after evaporation a fairly compact mass, which might be called 'clayey', but even when rubbed between the fingers had no sandy feel. The separation between 'clayey', and 'sandy' particles was thus not accomplished by the (*d*) method.

The writer has made further experiments to see if the behaviour of the fractions towards different colouring matters may perhaps throw light on the point. Whereas the particles of Fraction III obtained by the methods (*a*), (*b*) and (*c*) only fixed a small quantity of colouring matter (methyl violet), the result was on a much larger scale in the case of the particles obtained by method (*d*). I should like to recommend colleagues to make further experiments in this direction. It must be remembered that it is a question of a kind of adsorptive fixation so that the concentration and the quantity enployed of the methyl violet solution is of importance (7).

3. *Examination of Fresh Soil Samples.* — The following investigation is calculated to remove the prejudice against the HCl treatment. In February 1921, after a very wet winter a recently formed soil (Finsterwolderpolder, Prov. Groningen, dyked 1819) was examined. The soil was quite wet and contained 27 % water (dried at 105° C.). In comparison with other soil samples taken in the neighbourhood the volume weight (the weight of 100 cc. of soil in the natural condition in dry matter) and the specific weight are 1.25 and 2.5 respectively. The pore space is thus nearly 50, and if all pores are filled with water, the water content becomes nearly 28 per cent. Half the sample was examined in the wet state, the other as air-dry fine earth (size of

particles 2 mm.) and the following procedure was adopted in the preparation of the samples:

(*a*) Stir with H_2O in a mortar, allow it to settle, pour off into a litre flask (8), stir the remainder again in the mortar with water and pour off, repeat this several times, and finally rinse the whole soil sample into the litre flask. The litre flask is very slowly rotated in a rotary apparatus for two hours a day for two days, the content is rinsed into an ATTERBERG cylinder and Fraction I is decanted with water only. Fractions II, III and IV are as usual decanted with water. In the different fractions the content in $CaCO_3$ is determined and subtracted. The fractions are dried at 105°C. and not ignited.

(*b*) according to the English method as modified by the writer (4) the sample is agitated with 100 cc. excess cold 0.2 N. HCl and decanted first with water and then with ammonia. Fractions II, III and IV are decanted with water, dried at 105° C. and not ignited.

Finally the air-dried soil sample was treated according to the new method, i. e. boiling with H_2O_2 and 100 cc. excess 0.2 N. HCl and then treated as under (*b*).

It may be noted that only Fractions II, III and IV were weighed: the weight of Fraction I was reckoned from the difference. In the same way the $CaCO_3$ was determined only in the case of fractions II, III and IV, and in the case of I was estimated by difference. The results are shown in dry substance (see Table IV).

Later on it proved (see below) that the calcium carbonate does not pass completely into solution on treatment with cold HCl (method *b*). The figures of Fraction II (possibly also of Fraction III) are accordingly probably too high with method (*b*): the figures relating to Fraction I (44.1 % and 45.5 %) are correspondingly somewhat too low.

TABLE IV.

Soil Sample No. 851	Method	Humus	$CaCO_3$	Content in fractions I	II	III	IV
1 moist	a		8.8	42.2	31.8	16.9	0.3
2 »	b		8.8	44.1	30.0	16.5	0.5
3 airdried fine earth	a		8.8	25.5	36.6	28.6	0.4
4 »	b		8.8	45.5	30.4	15.0	0.3
5 airdried	H_2O_2-HCl (boiling)	2.6	8.8	48.3	25.0	14.8	0.5

It appears from the above that the treatment of the wet soil samples with water only (Method No. 1) yields almost the same results as the treatment with HCl (Methods 2 and 4). Also the differences between the results of (*b*) (Methods 2 and 4) and of the new method (boiling with H_2O_2 and HCl), or method 5, are not great. On the hand the differences are quite considerable between method 3, i. e. (*a*) applied to the air dried sample, and the other four methods. It is unconditionally established that the results of method 3, i. e. rubbing up of the airdried sample with H_2O in a mortar and rotation with water, are incorrect as regards the mechanical composition of this soil On the other hand it is proved that the treatment of the sample with cold HCl (No. 2 and 4, method (*b*)) and similarly with H_2O_2 (the ROBINSON method) and boiling HCl (Method No. 5) gives figures, which in any case do not differ very much from the figures of Method 1, i. e. the treatment and decantation of the wet soil sample with water only.

(4) *Boiling with HCl.* According to the new method, boiling with HCl takes place and by theROBINSON H_2O_2 method with 100 cc. 0.2 N. HCl excess; thus for example 10 gm. of soil with 7,5 % $CaCO_3$ are boiled with 175 cc. 0.2 n. HCl and 25 cc. H_2O for 15 minutes. The reason for this modification of the method is that the calcium carbonate is not fully dissolved by the cold treatment with dilute HCl. It has been observed that the boiling acid dissolves the clayey substances in not inconsiderable quantities. The writer had previously noted that the cold acid also dissolves the clay (4), and the question arises now whether in this respect there is much difference between the quantity dissolved by the cold acid and that by the boiling acid. Table V gives the results of an examination of certain samples. Naturally in addition to SiO_2, $Al_2O_2 + Fe_2O_3$ (Total acids), bases (CaO, MgO, K_2O, and Na_2O) are dissolved and in particular lime.

The boiling HCl dissolves the $SiO_2 + Al_2O_3 + Fe_2O_3$ more completely than the cold HCl. The difference however is not great, and in any case there is no ground for the view that the quantities dissolved in cold HCl are negligible as compared with those dissolved if boiling is effected. Hence the experimenter who does not hesitate to treat with cold HCl may also in my opinion, confidently employ the treatment with boiling HCl.

In Table V the content in Fraction I and II and the total acids ($SiO_2+Al_2O_3+Fe_2O_3$) are expressed in percentages of I and II (last column). Here somewhat considerable differences occur. In part-

TABLE. V.

Soil Sample No.	Percentage dissolved of dry substance: In cold or in boiling HCl	SiO_2	$Al_2O_3+Fe_2O_3$	Total acids	Fractions I+II in% of dry substance	Total acids in % of I+II
795	cold	0.8	2.06	2.86	67.1	4.3
	boiling	1.11	2.60	3.71		5.5
509	cold	n. q.	n q.	n. q.	40.2	n. q.
	boiling	0.77	1.20	1.97		4.9
1898	cold	0.42	1.24	1.66	76.3	2.2
	boiling	0.67	1.46	2.13		2.8
1900	cold	0.33	1.23	1.56	74.5	2.1
	boiling	0.64	1.53	2.17		2.9
1432	boiling	0.80	2.63	3.43	44.2	7.7
1433	boiling	0.68	2.52	3.20	43.4	7.4
1440	boiling	0.64	2.77	3.41	53.3	6.4

icular, taking the last three soil samples, somewhat large quantities in percentages of Fraction I and II are dissolved in the boiling HCl. These are three river clays of loamy character. A smaller total in $SiO_2+Al_2O_3+Fe_2O_3$ might have been expected. The proportion of $Al_2O_3+Fe_2O_3$ to SiO_2 is however greater in the case of these three soil samples than with the other samples. Possibly here we are dealing with a soil with a high content in easily soluble Fe_2O_3.

The question now arises whether any allowance can be made for the quantities that have passed into solution with the HCl treatment. They are removed on decantation of Fraction I according to the ATTERBERG method. In particular the acid will have dissolved a good part of Fraction I. Of Fraction II perhaps a rather smaller part will be dissolved, while the Fractions III and IV, on boiling for 15 minutes with the *very dilute* HCl employed remain practically insoluble. Since the total of the acids is not large, it can without hesitation be taken into account in the case of Fraction I: that is to say, that no correction need be applied for the Fractions II, III and IV.

5. *Calcium Carbonate.* — While hydrochloric acid is mainly used by the writer, on account of its solvent action on calcium carbonate, some colleagues give a warning against the use of acids on that account. I am of the opinion that the size of the particles of cal-

cium carbonate is of great importance in judging of the soil, and that it is advisable to determine this. I am unable however to find any indication that the different fractions have been tested as to their content in $CaCO_3$.

I expressed an opinion in Rome in May 1924, that it would be advisable in the case of soils containing $CaCO_3$ to determine, by taking a second sample, the dimensions of the $CaCO_3$ particles separately. The immediate question however is, how the soil samples are to be prepared for the determination of the dimensions of the $CaCO_3$ particles. The determination of $CaCO_3$ in the different fractions involves much time. In the soil sample No. 851 the results with the methods 1 and 3 (wet and airdried soil samples, see Table IV) were nearly the same (see Table VI). In the case of this soil the $CaCO_3$ particles were already separated from each other by rubbing in water.

TABLE VI.

Soil Sample No. B. 851	$CaCO_3$ in percentage of dry substances				
	I	II	III	IV	Total
(a) moist	4.5	2.0	2.1	0.2	8.8
(a) airdried.	4.3	2.0	2.4	0.1	8.8

TREATMENT OF THE SOIL SAMPLES WITH H_2O_2 (the ROBINSON method).

The proposal of ROBINSON (5) to boil the soil samples with H_2O_2 to the point of removal of the humus involves a great advance. This is not the place to enlarge on the whole question of the importance of the H_2O_2 treatment and I refer the reader on that account to the literature dealing with the subject (9). In a later article ROBINSON comes to the conclusion that the hydrogen peroxide has the effect of completely decomposing the organic substances which have become transformed into humus, or of depriving them of water, while it leaves unaltered the fibrous organic substances such as cellulose and lignin. Hence if the microscopic remains of roots etc. are removed by sifting, the H_2O_2 treatment may be expected to remove the humus either altogether or nearly so.

How far this is really the case, will appear from the following investigation.

The preparation of the soil sample was effected by the new method, i. e. boiling with H_2O_2 and HCl and decantation of Fraction I first with H_2O and then with NH_4OH and of the Fractions II and III with water. Fractions II, III and IV of this sample were first dried at 105°C. and then ignited. Table VII reproduces the results of Fraction II. On drying at 105°C. the soil sample No. 824 gave a Fraction II of 16.04 % and on ignition, of 14.17 % of airdried soil. The loss through ignition was thus out of 100 gm. of soil 1.87 gm.: i. e. in a percentage of Fraction II, 1.87 × 100: 16.04 = 11.7 % (Table VII, last columm). The content in $CaCO_3$ and humus in dry soil is also shown in Table III.

TABLE VII.

Soil Sample No.	% of dry substance		Fraction II gm. out of 100 gm. of air dried soil		Loss on ignition on 100 gm. Soil.	Loss on ignition in % of Fraction II
	$CaCO_3$	Humus	Dried at 150° C.	Ignited		
824	11.9	3.6	16.04	14.17	1.87	11.7
463	8.7	0	8.66	7.37	1.29	14.9
465	8.7	0	8.60	7.36	1.24	14.4
849	4.8	0	16.07	14.36	1.71	10.6
1100	10.9	0	11.23	9.76	1.47	13.1
796	9.2	2.9	23.38	21.93	1.45	6.2
952	5.0	10.5	20 62	19.07	1.55	7.5
800	0	10.7	19.91	18.72	1.19	6.0
830	0	10.0	25.64	24.37	1.27	4.9
1061	0	4.0	18.47	17.52	0.95	5.1
827	0	0	19.63	18.78	0.85	4.3
828 *a*	0	0	24.37	22.65	1.72	7.1
828 *b*	0	0	23.63	21.84	1.79	7.6
569	0	8.0	29.07	27.37	1.70	5.8

On ignition of the Fraction II airdried at 105°C., a reduction thus takes place of the content in Fraction II amounting to from 0.85 to 1.87 % on airdried soil: these figures are not large. On ignition of the Fraction III and IV a still smaller reduction takes place of at most 0.6 %, but more usually of some few tenths per cent. The reduction of Fraction II on ignition clearly does not result from the undecomposed remnant of the humus left from the treatment by H_2O_2. For Fractions II of the three samples soils that are completely free from humus and $CaCO_3$, viz. Nos. 827 and

828 (*a*) and (*b*), are also reduced by ignition, and in percentages of Fraction II (4.3 ; 7.1 ; 7.6) which are not less than the other soils free from $CaCO_3$ (for example, 800 with 10.7 % of humus and 6.0 % of loss on ignition), even if these soils are rich in humus. The loss on ignition of the soils containing $CaCO_3$ expressed as percentages of Fraction II, are however, with the exception of 796 and 952, higher, even if the soil is free from humus. The inference would seem to be, that Fraction II, even on boiling with dilute acid, may still contain some carbonate. Whether this is really the case has not up to now been further investigated.

The seven soils that are free from $CaCO_3$ show on an average 6 % of loss in ignition (as percentages of Fraction II), and as this loss is not connected either with humus or with $CaCO_3$ Fraction II thus contains an average of 6 % of hygroscopic moisture (min. 4.3 % and max. 7.8 %). The differences are probably due to the composition of the Fraction, i. e. whether there is more or less weathering of the silicates.

The conclusion is thus reached that the H_2O_2 ROBINSON treatment, subsequent boiling with HCl and decantation of Fraction I with NH_4OH, entirely decomposed and dissolved the humus. Quite different results are obtained on ignition of the Fractions after the old method has been followed, viz. treatment with cold HCl and decantation of Fraction I with ammonia and Fraction II and III with water. The difference is clear from Table VIII.

TABLE VIII.

Soil Sample No.	$CaCO_3$	Humus approx.	Fractions	in % of soil: dried at 105°	in % of soil: ignited	Ignition loss in % of soil	
805	0	16 %	II	29.1	23.8	5.3	8.1
			III	29.6	26.8	2.8	
812	0	34 %	II	28.3	22.1	6.2	11.0
			III	21.3	16.5	4.8	

Fractions II contained at most 7 % of hygroscopic moisture per fraction, which is approximately in the case of soils 805 and 812 at most 2 % of the soil. The ignition loss of $5.3 + 2.8 = 8.1$ % and $6.2 + 4.8 = 11$ % is thus due for the most part to the humus (approximately $8.1 - 2.0 = 6.1$ % and $11 - 2 = 9$ %).

Originally it was my opinion that it was essential to submit

the soils containing large quantities of humus to a dull heat before the H_2O_2 treatment. It has however now been established that even when large masses of humus are present (soils with nearly 60 % of humus have been the subject of experiment) the H_2O_2 treatment can decompose them. Treatment was of course carried out on 5 instead of 10 gms of soil. Ignition was not only unnecessary but even prejudicial, as the humus that has been ignited did not decompose fully under the H_2O_2 treatment. Fractions II and III and also IV thus contained humus, and moreover the mineral particles were firmly cemented together with humus that had been ignited and had remained undecomposed on treatment with H_2O_2. On investigation of a series of clay soils containing humus in large quantities the fluid remained turbid on decantation and the results were quite different from those of the non-ignited soils with H_2O_2 treatment. See Table IX.

TABLE IX.

Soil Sample No.	Percentage in dry substance in:			
	Humus approx.	Calcium carbonate	Fraction III IV (Sand) not ignited	previous ignition
1729	39	32.3	3,7	5.0
1730	46	25.9	4.7	5.0
1735	47	6.1	2.1	20.3
1738	66	1.6	2.2	11.0
1739	58	2.4	6.0	20.4
1744	55	0.6	13.4	25.0

DECANTATION WITH NH_4OH.

In my article which has already been quoted (1) I referred on page 7 to the effect of using dilute ammoniacal water for decantation. In an article which appeared recently BLANCK and ALTEN (11) come to the conclusion that a preparation of the soil with ammoniacal water for analysis by decantation on the ATTERBERG method cannot be recommended without reservation, for all soils, as the 2.5 % of ammonia solution under certain conditions has profound chemical effects which, in the instance investigated by BLANCK and ALTEN, have led to a considerable release of silicates whereby the whole decantation result, in the sense of the originator of the method, is rendered illusory. The behaviour of the Dutch

soils in this respect has not yet been investigated. It may be noted here, that in the decantation we always use a 0.1 % ammonia solution.

CONCLUSIONS.

On agitation with a slight excess of cold dilute HCl fairly considerable quantities of $CaCO_3$ remain undissolved, which on boiling with the HCl are completely or very nearly dissolved.

Somewhat more of $SiO_2Al_2O_3 + Fe_2O_3$ and bases are dissolved on boiling with HCl, than on agitation with cold HCl; the differences are however small. These quantities which go into solution on boiling with HCl probably belong for the most part to Fraction I. A correction in the case of Fraction II may probably stand as accepted and certainly without serious error in the case of Fraction III and IV.

On decantation of Fraction I with dilute ammonia — either after agitation or after the HCl treatment — not all the humus is dissolved. The fractions II and III (IV) may in the case of soils rich in humus contain considerable quantities of humus. On ignition of Fraction II, and also to a small extent in the case of Fraction III, hygroscopic moisture as well as humus is lost.

If the larger particles of organic substances such as the remains of leaves, roots, etc., have been removed by sifting the soil sample, the humus is practically completely decomposed by boiling H_2O_2 (ROBINSON method), and by further decantation with NH_4OH after boiling with HCl, or transformed into a dry form. Fractions II, III and IV are then practically free from humus. Ignition of these fractions for removal of humus is thus unnecessary. Since Fraction II still contains hygroscopic moisture, ignition of this Fraction brings out a small error.

Ignition of the soil samples, even if it is very carefully carried out, makes the organic matter harder to attack by the H_2O_2, so that after treatment of the ignited samples with H_2O_2 somewhat large quantities of humus remain in the fractions, which are not even dissolved by NH_4OH. These ignited organic remains cement the mineral particles firmly together, so that a much too low content in clay is found.

A combination of boiling with H_2O_2 (according to ROBINSON) and HCl and decantation of Fraction I with NH_4OH seems to be the most suitable treatment of the soil sample. The cementing

humus-$CaCO_3$-Clay-gels are removed so that a thorough separation of the mineral particles is achieved without their being affected in any way worth mention. In consequence of the ease with which separation is effected, decantation of all fractions proceeds very quickly. Boiling with more than 100 cc. 0.2 N. HCl excess is not favourable, as it necessitates more frequent decantation. From experiments which have not yet been published it has been found that with the combination H_2O_2 and HCl the carbonates dissolve more readily in the HCl.

Detailed Description of the New Method of Preparation of the Soil Samples.

10 gm. of air dried soil (in the case of soil very rich in humus 5 gm.), passed through a 2 mm. sieve are placed in the afternoon in a 750 to 1000 cc. beaker and 50 cc. of a 20 % solution of H_2O_2 poured on it. After some time frothing frequently takes place so that cooling off is necessary. On the next day the whole is boiled for 30 minutes in the bath, cooled, 50 cc. H_2O_2 again added and once more boiled for 15 minutes. If necessary the boiling with H_2O_2 may be repeated once again. Subsequently 200 cc. of dilute HCl is added with such quantity of HCl, that with 100 cc. 0.2 N. HCl more is available than is required for the solution of the calcium carbonate: boiling for 15 minutes over a naked flame follows with cooling off and the whole is washed into the ATTERBERG decantation cylinder. Decantation (10 cm. after 8 hours, or 20 after 16 hours), proceeds first with water till the acid reaction has disappeared, and then again with NH_4OH. After removal of Fraction I, decantation of Fractions II (10 cm. after 7.5 minutes) and III (30 cm. after 15 seconds) is effected with water. Fraction IV remains behind. Fractions II, III, and IV are dried at 105°C. and weighed. Fraction I is reckoned at 100 — (II + III + IV + Humus + $CaCO_3$).

As limits of the fractions the ATTERBERG limits are adopted:

Fraction	Vol. in cm.	Diameter in microns.
I	10 : 8 × 3600	< 2
II	10 : 450	2 — 20
III*a*	30 : 60	20 — 100
III*b*	30 : 15	100 — 200
IV		200 — 2000

Comparative Results according to the earlier method and the new method N.

With A the preparatory treatment is carried out with cold HCl and further decantation as above (see *Internat. Mitt. für Bodenkunde*, XI, Page 9). The new method N is that described above. Table X shows the results.

Table X.

Soil Sample No.	$CaCO_3$	Humus	Content in % of dry soil in I A	I N	II A	II N	III A	III N	IV A	IV N	Proportion I : II = I A	N
790	0.2	3.0	42.4	49.8	32.0	26.6	22.0	19.7	0.4	0.7	0.75	0.53
795	8.8	6.0	31.9	44.4	32.8	22.7	20.1	17.6	0.5	0.5	1.03	0.51
800	0.3	10.7	19.9	35.2	30.3	20.9	38.2	32.7	0.6	0.2	1.52	0.59
824	11.9	3.6	25.8	32.8	23.6	16.0	34.1	35.5	1.0	0.2	0.91	0.49
830	0.1	10.0	45.8	51.8	31.8	27.6	12.1	10.4	0.2	0.1	0.69	0.53
831	0.9	3.9	29.5	36.6	26.0	19.2	38.7	36.9	1.0	2.5	0.88	0.52
952	5.0	10 5	23.3	32.8	24.8	20.1	35.8	31.5	0.6	0.1	1.66	0.61
1096	1.8	1.3	19.9	25.9	19.8	15.8	52.5	51.0	4.7	4.2	1.00	0.61

According to the old method A the content in Fraction I is always smaller, in Fraction II is always larger, than with the new method N. The differences are very considerable, as also is noticeable in the proportion I : II with A and N (last two columns). The differences in the case of III (and IV) are very slight. To a very small extent the differences are to be ascribed to the fact that Fractions II and III by the A method may still contain $CaCO_3$. They arise mainly however from the fact that (by the N method) the cementing $CaCO_3$ — Humus — Clay media have been removed by boiling with H_2O_2 and HCl.

Concluding Observations.

A brief note may be added on the following points :

(a) *The form of the* Atterberg *decantation cylinders.* — Immediately after the war, new decantation cylinders were ordered. The syphon tube of the new cylinders was however differently shaped from that of the old cylinders, which occasioned great differences in the results.

Soil Sample	I + II	III + IV	I + II	III + IV
	Old form		New form	
882	11.8	83.5	16.9	78.4
883	22.9	73.6	37.2	59.3
884	12.2	85.3	18.8	78.8

The old form (2) was retained. If the ATTERBERG decantation apparatus is to be adopted as the standard apparatus (12), it will be necessary to place the order for the instruments with one and the same firm.

(b) *Angle of inclination of the plane of setting up of the decantation cylinder.* — A portion of the soil particles as they settle are deposited in the front limb of the syphon tube of the cylinder. It seemed likely that these particles, at least in part, would be floated off. In order to prevent this, the Fraction I was always in the first place syphoned off very slowly, in 10 or 15 minutes. Later on the plane surface on which the cylinders stand was given a slight inclination of 3°, and in such a way that the syphon was somewhat raised. Contrary to our expectation we found that in this way rather more of Fraction I was decanted.

Soil Sample No.	Angle of Inclination	Fraction (average of 6 determinations			
		I	II	III	IV
B	0.	45.5	30.4	15.0	0.3
	3°	47.0	28.8	15.1	0.3

In the case of very sandy soils the results, especially for the sand fractions, were much altered :

<table>
<tr><th rowspan="2">Soil Sample</th><th rowspan="2">Angle of Inclination</th><th colspan="4">Fraction</th></tr>
<tr><th>I</th><th>II</th><th>III</th><th>IV</th></tr>
<tr><td rowspan="2">960 . . . .</td><td>0°</td><td colspan="2">2.0</td><td>19.1</td><td>78.5</td></tr>
<tr><td>3°</td><td colspan="2">1.7</td><td>10.7</td><td>87.2</td></tr>
<tr><td rowspan="2">961 . . . .</td><td>0°</td><td colspan="2">2.2</td><td>20.0</td><td>77.4</td></tr>
<tr><td>3°</td><td colspan="2">2.8</td><td>13.5</td><td>84.4</td></tr>
</table>

The separation of fractions III and IV is probably better effected with the KOPECKY apparatus. In the case of a series of very sandy soil samples a complete separation of the fractions III and IV cannot be successfully effected.

(c) *The rate of decantation and the size limits of the fractions.* — Following ATTERBERG decantation, the point of removal of Fraction I takes place with a height of water in the cylinder of 10 cm. after 8 hours (or 20 cm. after 16 hours). In the STOKES equation:

$$V = K \times r^2$$

which is naturally only true for spherical particles, thus becomes $V = 10 : 8 \times 3600$ and $r = 0.0001$, which gives $K = 34722$. The other two rates of decantation by the ATTERBERG method are $V = 10 : 450$ and $V = 30 : 15$, which with $K = 34\,722$ gives $2r = 16\mu$ and $2r = 152\mu$. The ATTERBERG fractions thus would lie between the following limits:

Fractions		Dimensions in Microns	
I	< 2		< 2
II	2— 16	instead of	2— 20
III	16— 152	» »	20— 200
IV	152—2000	» »	200—2000

We have however always retained the limits of the fractions as stated by ATTERBERG (2 — 20 — 200 — 2 000 as in the last column of the above table). It is essential in each case to mention the rate of decantation in use.

(d) *The* SIKORSKY *decantation apparatus.* — SIKORSKY decants after 1000 seconds and with a height of water of 20 cm.: thus $V = 20 : 1000$, which with $K = 34\,722$ gives a diameter $2r = 15.2\mu$. The so-called clay fraction of SIKORSKY is thus nearly equal to the fractions I + II of ATTERBERG, which we found to be established for a large number of soil samples. The SIKORSKY apparatus is very rapid in working. If therefore it is a question of a large number of soil samples of the same type the sand content (size of particles $2r = 15\text{-}16$) may be determined according to SIKORSKY and then an exact mechanical analysis made of some typical soils into Fractions I, II, IIIa, IIIb and IV.

B. SEDIMENTATION METHOD.

(ODÈN-WIEGNER and KRAUSS-ROBINSON).

Some brief observations on the sedimentation method may be made here. While in the decantation method the electrolytes present in the soil or added to it are removed by decantation of Fraction I together with a part of Fraction I, the removal of these electrolytes in the case of the different sedimentation methods must take place *before* the sedimentation and without any removal of particles of Fraction I. Thus there must be filtration and washing out with distilled water before the sedimentation. A short time ago MIECZYNSKI and SOKOLOWSKY (13) pointed out that in the separating out of the soil particles a reversible process was involved, so that as in all reversible reactions the freed particles must be removed. In this case it will be necessary to treat the mass of soil afresh after the filtration and washing out, for example, by agitation with dilute ammoniacal water.

Of the various sedimentation methods I have had personal experience only of the pipette method according to ROBINSON (14). The following detailed observations thus apply only to the ROBINSON method and the KRAUSS similar method (15).

1. In the ATTERBERG decantation method Fraction I is estimated from the difference (100 — ($CaCO_3$ + Humus + II + III + IV)). Since the quantities of SiO_2 $Al_2O_3 + Fe_2O_3$ and other bases dissolved in the course of the treatment with HCl originate mainly from Fraction I, no correction is necessary. In the sedimentation methods Fraction I is weighed, and hence a correction must be made for the substances which are dissolved in the course of the HCl treatment.

2. The same holds good, if the fractions are ignited instead of being dried at 105°. Fraction I in particular contains much hygroscopic moisture, so that on ignition of this fraction there may be a fairly large error. In the case of very clayey soils there may be found up to approximately 5 % of hygroscopic moisture (in percentage of dry soil).

In Table XI some comparative analyses made by the ROBINSON pipette method and the Groningen method are placed side by side. The preparatory treatment by the pipette method was carried out by the new method, viz. H_2O_2-HCl treatment. According to a verbal account given by ROBINSON the material was then filtered

and washed out with H_2O, the whole mass of soil placed in a litre flask with 500-600 cc. of water, mixed with 50 cc. of 10 % ammoniacal water and agitated for three days. This soil washing was then filled up to one litre with water, thoroughly shaken and placed in a cylinder. Pipetting was then employed at the 20 cm. level after 15 minutes (V = 20 : 200, hence the ATTERBERG fractions I + II) and at the 20 cm. level after 16 hours (V = 20 : 16.3600) hence the ATTERBERG fraction I. Fraction I + II and I are dried at 105° and not ignited. The loss from ignition has all the same been estimated and is inserted under G in the last column of Table XI. In the liquid filtered off after the HCl treatment, SiO_2. Al_2O_3 + Fe_2O_3 and CaO were identified and inserted on Table XI in K as value in a percentage of the soil. This correction is taken into account, i. e. that Fraction I is already increased by that value. If this correction K is not made and if moreover the fractions are ignited instead of dried at 105°, the following results are obtained, for example in sample No. 795, by the ROBINSON pipette method (R) : I = 37.2 (instead of 46.2), II = 21.5, III = 26.5, (instead of 17.5). The effect is thus very noticeable in the case of these heavy soils.

TABLE XI.

Soil Sample No.	Content in percenteges of dry soil in									
	$CaCO_3$	Humus	Fraction I		Fraction II		Fraction III + IV		K	G
			Gr	R	Gr	R	Gr	R		
509	4.0	1.5	24.9	26.8	15.3	12.4	54.3	55.3	2.0	3.9
795	8.8	6.0	44.4	46.2	22.7	21.5	18.1	17.5	3.7	5.3
1898	0.4	2.5	47.2	47.6	29.1	26.1	20.8	23.4	2.8	4.7
1900	0.2	3.0	46.2	46.5	28.3	24.9	22.3	25.4	2.9	5.3

There is a fairly close correspondence; in comparison with the correspondences usually existing between similar analyses it may be called very close. It is to be hoped that ROBINSON will issue precise instructions for the use of his pipette method, and will give particular attention to the following points: (1) treatment with cold or boiling HCl; (2) correction K; (3) ignition or drying at 105° of the Fractions.

D. J. HISSINK,
Groningen, Holland.

NOTES AND BIBLIOGRAPHY.

(1) *Int. Mitt. f. Bodenkunde,* IV, pp. 7-18, 1914.

(2) *Int. Mitt. f. Bodenkunde,* II, pp. 320, 1912.

(3) A. D. HALL, *J. of the Chemical Society.* Transactions 1904, Vol. 85. Part II, 950 and 946.

(4) *Int. Mitt. f. Bodenkunde,* XI (1921), Page 9.

(5) GILBERT WOODING ROBINSON, M. A.; Note on the Mechanical Analysis of Humus Soils *Journal of Agricultural Science,* XII, pp. 287-291, 1922.

(6) KÖNIG and HASENBEUMES have criticised this method in the *Landwirtschaftlichen Jahrbüchern* (Agricultural Yearbooks) (LVI, 1921, page 449). On page 443 emphasis is laid on the fact that to avoid flocculation of the soil colloids distilled water must be used for the decantation of the first fraction, and that on this account the use of HCl as by HISSINK gives rise to errors. They have obviously failed to note that the decantation of Fraction I is carried on with distilled water until the electrolytes are removed. This stage in the process is recognised by the fact that the suspended matter in the cylinder becomes markedly turbid.

(7) The figures supplied by KÖNIG (see edition 1923, page 112) have only relative value.

(8) The STOHMANN litre flasks were employed, as in the analysis for superphosphate.

(9) In this periodical, Part I, page 6, an article by Dr. L. SMOLÍK appears on the hydrogen peroxide catalysis of the Moravian soils.

(10) *Journal of Agricultural Science,* XV, Page 29.

(11) Ein Beitrag zur Frage nach der Vorbehandlung der Böden mit Ammoniak für die ATTERBERG'sche Schlämmanalyse by E. BLANK and F. ALTEN; *J. f. Landwirtschaft* (1924) Page 153-163.

(12) See Resolution 4 of the Berlin Meeting, *Int. Mitt. f. Bodenkunde,* IV, Page 30.

(13) Die Untersuchungen über den Einfluss verschiedener Vorbereitung der Bodenprobe auf den Verlauf des Schlämmprozesses by F. MIECZYNSKY and MAYAN SOKOLOWSKI. *Mémoires de l'Institut national Polonais d'économie rurale à Pulaw.* Vol. IV, 1923, Summary 109-111.

(14) GILBERT WOODING ROBINSON, A new method for the mechanical analysis of soils and other dispersions; *The Journal of Agricultural Science.* XII, 306-321, 1922.

(15) GUSTAV KRAUSS, Ueber eine neue Methode der mechanischen Bodenanalyse etc. by *Int. Mitt. f. Bodenkunde,* XIII, pp. 147-160, 1923.

THE DEGREE OF SOLUBILITY OF PHOSPHATE AND POTASH FERTILISERS NECESSARY TO MAINTAIN THE SOIL SOLUTION AT THE CONCENTRATION REQUIRED BY PLANTS.

Phosphorus and potassium are necessary to plant life and if these two elements are lacking, plants, after having assimilated the small quantity of phosphorus and potassium contained in the seeds, lose their vitality and die.

Phosphorus and potassium are deficient in most soils, except those of volcanic origin; hence the necessity of supplying non-volcanic soils with the quantity of phosphorus and potassium necessary for plant life.

Phosphorus is contained in large quantities in the natural phosphates, and potassium in rocks of the leucite and phonolite type.

Phosphorus and potassium, in order to be absorbed by plants, must be dissolved in water. It is also necessary that these phosphate and potash solutions should contain only a minute percentage of dissolved matter; for instance, a one per cent solution ceases to be nutrient and becomes toxic, and the plant in contact with it withers and soon dies.

The optimum *total* saline concentration of nutrient solutions for wheat, for instance, has been found to be 0.3 parts per 1000. A solution of this concentration, however, contains such a small quantity of dissolved nutrient substances, that the plants would soon exhaust them, when plant life would become impossible.

In order that this very weak solution should not become impoverished, an intermittent supply of nutrient salts is necessary, which would replace only those substances in the solution as they become exhausted or deficient, and in such quantities as to reach, but not exceed, the necessary concentration.

This may appear to be an unattainable ideal, and yet it is realised to a considerable extent in naturally fertile soils, and the process may be regulated by a far from complicated method.

No chemical transformation of the crude phosphatic or potassic substances is necessary, it is sufficient if they be finely ground and well mixed, and applied to the soil in the same quantities and in the same manner as is done in the case of other chemical fertilisers.

The mineral phosphates alone are too insoluble, *i. e.*, they give

solutions which are too weak ; when merely mixed with crude potassic compounds they become much more soluble in water, and give stronger solutions than when alone (a chemical phenomenon of double decomposition), and of the strength required by plants (*Proceedings of the IV International Pedological Conference* — Report No. 20 — Commission II).

As the mineral phosphate is brought to the optimum degree of solubility by the presence of the slightly soluble potassic salts of the leucite type, so these potassic salts attain the required solubility by the presence of the raw phosphate.

The degree of solubility adapted to plant life is thus attained ; it follows that in applying the mixture to the soil, if the soil solution is too weak it would quickly be strengthened to the desired degree, which cannot be exceeded as the mixture cannot give stronger solutions.

By the presence of the mixture in the soil, therefore, every decrease of nutrient phosphatic and potash salts in the soil solution, from whatever cause, would be followed by a corresponding increase, and the percentage of phosphorus and potassium in the nutrient solution would remain constant and retain that value which is adapted to plant life.

Thus, by simply grinding and mixing, the natural phosphates and volcanic rocks of the leucite type are made suitable for fertilising purposes, and from both a scientific and economic point of view the method cannot be improved.

The present system of chemical fertilising dates back to 1840 and corresponds to the scientific knowledge existing at that time.

It was only known then that plants derived nutriment from the matter dissolved in the soil water ; it seemed that the optimum must be attained by transforming the mineral phosphate into a compound which would dissolve in water like the more soluble salts.

The mineral phosphate was treated with sulphuric acid, and a mixture was obtained of double the weight of the original substance and of which about 50 % was chalk and very acid phosphate. This mixture, owing to the large quantity of sulphuric acid necessary and the cost of manufacture, cost about four times as much as the original phosphate. The name of superphosphate was given to this mixture (it does not contain the slightest trace of superphosphate) and its property of dissolving in a small quantity of water was thought to be a great advantage in agriculture. Erroneously, it

was said to dissolve completely because very soluble, as though the slightly soluble matter did not also dissolve completely. The difference between very soluble and slightly soluble, consists only in the fact that the former needs less water than the latter to dissolve completely, and that consequently if the former is not in contact with large quantities of water it gives very strong solutions, whereas the latter whatever be the quantity of water gives weak solutions.

When the dissolved substance is taken (as, for instance, by plant absorption) from these weak solutions, obtained from slightly soluble substances, other matter immediately dissolves, bringing back the solution to its original strength, this process continuing until the soluble substance is exhausted. Hence, the whole of the said substance is completely dissolved and utilised in its best form, for the plant is thus always in contact with the dilute solution best suited to it.

Now that it is known that strong solutions are not an advantage but an absolutely toxic factor for plants, the " superiority " of the highly soluble salts gives way to that of the slightly but sufficiently soluble substances. As the slightly but sufficiently soluble salts cost about a fourth of the highly soluble, this information should be made known to farmers in order that in their own interest and in that of the nation they should take measures towards a more scientific fertilisation of their land.

Mention should be made of the following advantages which may also be derived from this solution of the problem of chemical phosphatic and potassic fertilisation:—

The utilisation of all phosphate deposits, on the sole condition that their phosphorus content be not so low as to render their transport inconvenient. In Italy, the utilisation of Italian and Lybian natural phosphates is made impossible in agriculture, not because they are of poor quality, but because they are rejected by the superphosphate industry. These phosphates indeed contain on an average more phosphorus than those existing in superphosphate. Too much sulphuric acid however would be required to convert it into acid phosphate (superphosphate) as it contains a deacidifier, carbonate of lime (a valuable substance for agricultural soil), in larger quantities than the French African phosphates.

The proper utilisation of the deposits of slightly soluble potash (in Italy they are of the leucite type);

No increase in the weight of mineral phosphate, as caused for

the mere object of dissolving the phosphate ; in superphosphate the weight is double;

The fresh impetus given to chemical fertilisation, an enormous quantity of sulphuric acid being no longer necessary (the annual requirement in Italy is at present about six million quintals);

No detrimental effect of the fertiliser on acid soils, or on those deficient in carbonate of lime. The use in agriculture of potassium and phosphorus in their natural state, at about half the present cost of phosphates.

By bringing about and maintaining the concentration of soil solution to plant life, as shown by soil science and plant physiological research, it is evident that all the characters in plants most useful to us will be reinforced, and both the quality and quantity of agricultural production will be increased.

ROMUALDO AVATTANEO.

Abstracts and Literature.

General.

Animal Life in Deserts.

BUXTON, P. A. *Animal Life in Deserts*, published by Edward Arnold and Co. Price 10s. 6d. London, 1923.

The notes on desert climate in the first chapter should be of interest to the soil scientist. All the climatic factors are treated; water, temperature, relative moisture, wind, evaporation and light. The second chapter describes the soil and the water courses in their relation to the fauna, the subject being handled with special vividness.

When the author goes on to show that dune-sand, resting on impermeable rock, is especially indicated for grape-growing and gives as an example the region south of Jaffa (Page 42), it would seem that the possibility of cultivation in that particular spot is due to the fact that the dune sand rests partly on a so-called "Chowrah" of red earth, and in many places it is of such recent origin that signs of previous cultivation can be observed in the subsoil.

The third chapter describes the flora, while the fourth and fifth are devoted to the fauna and the physical conditions of their surroundings. The sixth chapter deals with the relations between animals and plants, and the seventh contains certain observations on the colouring of desert animals.

The author is well acquainted with the desert of South-west Per-

sia, Lower Mesopotamia, Syria and Palestine. It is impossible to deal in a brief note with the full detail which is of great interest. The value of the book is increased by the excellent photographic reproductions. The first edition is exhausted. REIFENBERG.

Geology.

POTONIÉ, R. and SEITZ, O. in collaborations with other experts, *Bucherei für Landwirte*, edited by H. v. LENGERKEN, Published by Walter de Gruyter and Co. 150 illustrations, 274 pages. Price 10m.80, Berlin-Leipzig, 1925.

The agriculturist, like the engineer and the miner, has the right to expect that geological knowledge shall be available for him in a form and to an extent such as fall naturally into the framework of his scientific education and in some relation to the work which comes to him in the course of this vocation. The present volume " Geologie ", in the " Bücherei für Landwirte " series, meets this requirement, as besides giving the general scientific principles of general and historical geology, it treats in full detail the subjects especially important for the agriculturist, such as the transformation of rocks, weathering and soil formation, soil water, etc., while dealing with the theory of stratification, and more especially with palaeontology as shortly as is compatible with any kind of geological studies and the comprehension of geological maps. The authors have hereby taken the best line that a " Geology for Farmers " can take, so that the book is undoubtedly one to recommend. It contains a series of instructive diagrams ; but it would have been advisable to have added a geological outline map or a rough sketch of a geological land map. SCHUCHT.

Soil Morphology and Agricultural Science.

SACHAROW, S. Prof. *La Pédologie*, Nos. 1-2, Moscow, 1924.

1. The results of the examination of soils should be utilized to a much greater extent by scientific agriculturists.

2. In practice, agriculturists are mainly concerned with soil morphology and topography. All knowledge of the soil begins with the knowledge of soil morphology.

3. Of all the subjects included under soil science, soil morphology is the one that can be chiefly applied to agricultural practice.

4. It is therefore desirable that both theoretical and practical instruction in the subject of soil morphology and soil topography should be given in the form of higher school courses, and that both laboratory and field work should be carried out. *Author.*

Peat and its Applications.

STEINERT, Joh., Ing. Chem. Der Torf und seine Verwendung. Published by Walter de Gruyter and Co. Berlin and Leipzig, Goschen Series, Vol. 895, 66 illustrations. 1925 : Price 1.25 Marks.

In this book all essential information as regards peat and the uses of peat has been put together in small compass by an experienced hand. The

scientific section deals with the origin and different kinds of peat, as well as its physical and chemical properties; the technical section describes the preliminaries of the enclosure of moorland, the removal of the peat from the moor, transport and drying. Further treatment and uses and possibilities of development are also discussed. SCHUCHT.

Properties of the Soil and their Improvement as a Basis for a general Farming Scheme.

VITINS, J. (J. WITYN) 32 pp. (Lettish). Riga, 1923.

In consequence of the land reform in Latvia there has been a great increase in the number of medium-sized farms (14-16 hectares). On some of the farms improvement of arable land has been carried out with the following results as to quality of soils: Class I to II, less than 0.5 %; Class III, 4 %; Class IV, 13 %; Class V, 28 %; Class VI, 18 %; Class VII, 2 %. A large number of determinations of soil reactions, in all more than 600, went to show that, speaking generally, only the soils of Classes I to III are completely or nearly neutral; that the soils of Class IV often require lime, although good yields may be obtained from them by careful cultivation and plenty of manure. All the other soils, i. e. 87 % of the total, respond to treatment with lime, especially from Class IV onwards. The majority of the farms have poor, highly "podsolic" soils, the average yields of which are from 7-12 quintals per hectare. It is difficult for the farms to maintain existence with such yields, nor can any satisfactory scheme of farming be established. The strongly podsolic soils are usually found in regions with heavy rainfall (more than 600 mm.), while on lighter mother rock they occur everywhere. The first steps to be taken by the landowners and also by the authorities for the improvement of these soils must be in the direction of diminution of acidity. This treatment should not present difficulty since there is an abundance of calcareous material in Latvia. The treatise contains numerous soil analyses and descriptions of good soil requiring no lime, and also of the poor soils with high lime requirements. L. FREY.

Short Manual of Soil Science for the Use of Surveyors and Agricultural Technicians.

VITINS, J. (WITYN, J.), 110 pages (in Lettish). Riga, 1923.

The author gives in this book a general outline of the science of Pedology together with a description of the most important mother rocks of Latvia and of the soils formed from them, i. e. of the extent of the transition of soils into the podsol type. The degree of podsol formation may be considered as a basis for improvement of new, recently cleared soils.

The soils of Latvia are divided into 8 principal categories as regards mprovement. The fertility of the heavy clay soils and of the sandy soils is markedly diminished by transition to the podsol type, in the sandy soils by the formation mainly of a smooth very acid horizon of "Ortstein". The fertility of the sandy clays with a clay content of 10-30 % is dimi-

nished only very gradually, but the yields are much reduced if the lime requirement of the soils is about 6 tons $CaCo_3$ per hectare.

The author recommends that special attention be given, when undertaking improvements, to the development of the soil profiles, to the colour, structure and the soil water conditions. In particular, attention is to be paid during improvements of soil which is rich in humus. Richness in humus of soil in the Podsol zones is either the sign of neutral soil — the yields in this case are very high if the subsoil is not too coarse-grained — or the sign of poor aeration and the proximity of soil water — in the latter case, the soils are of little value as arable land although well suited for artificial meadow and pasture.

The content in organic matter of the higher categories of arable land is about 1-2 %, and only reaches 4 % in the non-podsol soils : in the lower categories it often falls below 2 %, usually it is about 3 %, although these soils are much lighter in colour. L. FREY.

Experiments with Subsoiling, Deep Tilling and Subsoil Dynamiting.

The Illinois Experiment Stations Bulletin, No. 258.

Deep plowing and subsoil dynamiting experiments in Illinois, as well as in other States, indicate that these tillage methods cannot be expected materially to increase crop yields. That such methods are not superior to ordinary or medium-depth plowing has been indicated by subsoiling experiments conducted by the Illinois Agricultural Experiment Station on grey silt loam on light clay at Odin, Marion county : subsoiling, deep tilling, and dynamiting experiments on grey silt loam on light clay at Toledo, Cumberland county ; and deep tilling experiments on brown silt loam at Urbana, Champaign County.

Soil moisture determinations made during two seasons on the variously tilled plots at Toledo show that none of the tillage treatments used increased the downward movement of moisture through the soil.

X.

Soil Pysics.

The Temperature of the Surface of Deserts.

The Buxton P. A. *Journal of Ecology*, Vol. XII, No. 1. January, 1924.

The author while studying animal life took up the study of the temperature of desert soils. There is no difficulty in the estimation of the temperature of light soils, whereas heavy soils present various obstacles. When working on gravel or lava soils, the author has overcome the difficulties of the ordinary thermometer by the utilization of a thermometer in the form of a wax scale, with different melting points. In June and July the temperatures of the soils of Palestine are between 55 and 62°C. While theoretically the temperatures of the soils in the Jordan valley, which in some cases are over a 1000 m. below the elevation of Jerusalem, should be lower than the temperature of the mountain soils (due to the

fact that the sun's rays are absorbed by atmospherical vapours), in reality the contrary is the case. The author states that this is caused by the walls of the valley which act as reflectors of the sun's rays.

The author has also found that the slope of the ground has an important bearing upon temperature. REIFENBERG.

Note on Capillary Rise in Soils.

GAROLA C. V. and CHARTRES. Etudes sur l'ascension capillaire dans les sols. *Annales de la science agronomique*, No. 1, pp. 1-32, graphs. 1925.

These notes of the late agronomist have been compiled by Mdlle Garola, his collaborator.

The first chapter deals with the calculation of the probable height of capillary rise, dependent upon the diameter of the tubular passages and consequently of the soil pore spaces, using the following formule :

$$h = 2\ f : dr.$$

h = the height in mm. ; f = surface tension of the liquids ; d = its density ; r = radius of tube in mm.

As there are, per gm. of soil, 43 milliard grains of raw clay (of a diameter 0.000279 cm.) ; or 34 million grains of silt ten times larger ; or 5 thousand grains of sand of half a millimetre.

Consequently these last are not concerned with capillarity.

Çhapter II deals with the experimental determination of capillary rise in different soils, by the use of an apparatus which resembles the " Evaporomètre enrégistreur " of HOUDAILLE. The experiments refer to sand, silt and silicious clay.

In sand, water rises very quickly but only to the small height of 55 cm. after 3 days and remains at that height.

On the other hand, in the silts of the high plains of the province of Beauce the absorption is slower at the beginning but continues during a week and reaches a height of nearly 80 cm.

In the sample of silt from Lomas de Zamora near Buenos Ayres and in silicious clay, the capillary rise is considerably slower, as the water takes 191 days to attain the height of 1 metre.

In the last experiment the heights reached after equal intervals of time represent a logarithmic scale. The quantity of absorbed water follows a similar curve.

The data of experiments are as follows :

	Percentage of clay present	Time required to reach 0.50 m.	Relative speed.
Silt without clay	0	12 hours	100
» from Beauce	18	37 »	33
» » Zamora	32	123 »	10
Silicious clay	37	576 »	2

If there is more than 18 % clay the capillary rise takes place as in the case of pure clay, because it fills all the empty spaces and thus the diameter of the capillary tubes is determined. PIERRE LARUE.

New Apparatus for Determination of Soil Permeability.

SPIRHANZL, J. *Zemedelsky Archiv.* Prague, 1924.

A sample of the soil is taken by means of a steel cylinder. This column of soil, having a height of 10 cm., is subjected to the penetration of water at a constant hydrostatic pressure. The relative permeability of the soil is expressed in cc. of water which have penetrated the column of soil having a basal area of 10 cm² and a height of 10 cm. and with a hydrostatic pressure of 100 cm., for a period of 24 hours. SMOLÍK.

Soil Chemistry.

Researches on the Formation and Decomposition of Humus in the Soil.

BALKS, R. Untersuchungen über die Bildung und Zersetzung des Humus im Boden. *Landwirtschaftliche Versuchstationen,* 103-221. 1925.

The catalytical power of the soil produced by enzymes and colloids is increased by the use of farmyard manure when it is first applied, but later on diminishes. The same effect is shown with pure nitrogen and its easily soluble compounds; after the use of dung the effect first increases and then diminishes. The author states that the amount of carbon found in the soil is less after oxydation with an aqueous solution of chromate than that found in a preliminary analysis. The experiment with chromate of silver, carried out by von SIMON, corresponds with the results of the analysis. The experiment carried out by PIETTRE with the pyridin method proved less successful. TOLLENS method for the determination of pentozans in the soil is useful, but no suitable method has yet been established for the investigation of hexosans. The methoxyl data given by ZEISEL and FANTO show the amount of lignin in the soils. The gradual oxydation of the humus was shown by a slow decrease of the carbon content after the application of farmyard manure. The author observed that the quantity of humus decreases more slowly in chalky soils than in soils with little chalk. This observation differs from the general opinion hitherto held, but is in accord with the experiments of ZOSSOWITSCH and FRETJAKOW. This phenomenon can probably be explained by the fact that the soil acids are combined with the excess of calcium carbonate and are thus protected from rapid oxydation.

K. SCHARRER.

Chemical Decomposition in the Egyptian Deserts.

BLANK C. and PASSARGE S. with the co-operation of RIESE, A. and HEIDE F. University of Hamburg. Die chemische Verwitterung in der ägyptischen Wüste. *Abh. a. d. Gebiete der Auslandkunde,* Vol. M, Serie C, Naturw. V. 6. Hamburg, Komm. Publ. by L. Friedriechsen u. C°, 1925.

In this book, PASSARGE gives illustrations of materials collected in Egypt in 1914, dealing with researches in soil experiments. The ana-

lysis of PASSARGES's experiments have been carried out by C. BLANK and collaborators in the Institute of Agricultural Chemistry and Soil Research at Göttingen University.

The first part deals with the geological formation of the territory travelled over and of the phenomena of decomposition of the soil Then follows a full description of the Assuan plain. PASSARGE classifies his results as follows: In the Egyptian deserts are found various soil. strata in a state of decomposition lying anderneath the superficial layer which was formed by alluvial deposits. The decomposition is apparently caused by the corrosive action of salts, which absorb and retain great quantities of water, due to the fact that the rainfall is sometimes very heavy. These decomposed soil strata found underneath the superficial layer, formed by alluvial deposits, have a depth similar to that of the soil strata found in Germany under dense vegetation, which is from 10 to 50 cm. Even the most resistant rocks, such as granite, gneiss, quartz, etc. are altered into an ashen, salty dust by the corrosive action of the salts.

All stony particles in the decomposing layers of earth are thickly covered with a reddish, or yellowish-brown dust. When such stone particles are transported to the surface they become darker, due to the loss of water, which is caused by the absorption of moisture by the sun and warm winds. These stony particles when exposed to the air for any length of time undergo a further decomposition both mechanical and chemical. In the first case, mechanical, the change is caused by the temperature variations. In the second case, chemical, it is brought about by the penetration of the salty-yellowish dust into all the fissures and crevices of the stony soil, which causes the breaking away of scales and all sharp particles. Smooth surfaces, such as for example, the old Egyptian blocks of stone, for a long time are not affected by any corrosive action, or decomposition. On the other hand, rough surfaces such as pieces of shale-like rock decompose very readily when exposed to the air, owing to the penetration of the dust into the fissures, as occurs in Germany in rocks found under moss.

The conclusion of the first part of the article can be summarized by the statement, that, the Egyptian Desert may be considered as a region of important chemical decomposition. In the second part C. BLANK supplements the information of the chemical decomposition of the Desert already known, and in the third part deals with research work concerning decomposition in Egyptian deserts.

The results can be briefly stated as follows:

(1) Chemical decomposition in the deserts is progressing at a much greater rate than scientists in the past believed to be the case. Especially to be noted is the diminishing of silicic acid and the rapid decomposition of calcium silicates, in contrast to the greater resistance of sodium silicates. This contrast is to be found in nearly all rocks and their products of decomposition, and characterizes the process of decomposition by definite features.

(2) Of the soluble salts that may cause crust or concretion formations, it is found that gypsum and sodium chloride are the most prevalent; while there are other sulphates, they are only found in small quantities. Calcium carbonate and other carbonates are in such small quantities that they need not be considered.

This statement agrees with the theory of FUTTERERS in so far as a a small percentage of NaCl and $CaCO_3$ on the one hand and a predominance of sulphate on the other, but not Na_2SO_4 but $CaSO_4$°.

(3) The zone in which gypsum is found according to BLANCKENHORN ends in the South in the neighbourhood of Thebes, but through the investigations described in this article it is further extended to the region of Assuan.

(4) The so called "Protecting crusts" which are principally composed of iron or manganese, are consequences of some internal force or action and are not caused by any external agents.

(5) In the Schellal Desert the soil formation may be considered as semi-arid and in some places is even humid. These soils are of silicate decomposition products similar to those of laterite. Contrary to expectations, the investigations have been unable to prove that the soils of the desert are of an extremely arid nature.

(6) There are two different theories in regard to the formation of ithese soils: first, that the decomposition is caused by the action of chemcal agents that rarely appear, but when they do, the reaction is violent and definite; secondly, that in some remote period during formation of the soils, there existed a very humid climatic condition. In regard to the first supposition, no satisfactory proof can be offered by us, because our present knowledge of the reaction of the chemical agents found in the desert is not sufficient. The possibility of attributing the decomposition to the rains, which are of high temperature, although very rare, is a unanswered question. Also, can it be attributed to the influence of dew, the crystallization of salts, the influence of ozone, of nitrates or similar agents? Other authors have declared these to be determining agents in this process of decomposition, but we have no proof of this.

Taking into consideration all the above mentioned theories; we are of the opinion that the decomposition is rather caused by a former humid period, as the layers of soil and their chemical composition substantiate this theory. It is quite possible that after this humid period there developed an arid period and this is more or less substantiated by leading authorities on the subject to-day. However, in view of the available information on the subject we are of the decided opinion that the question of decomposition in purely arid places is a problem yet to be solved. This is in great part caused by the fact that up to the present time we have not had the opportunity to carry out researches in a region which has been shown always to have been arid.

SCHUCHT.

A Chemical Examination of Sand from the Mediterranean Coast of Palestine.

BRAVER, A. I. Die Resultate einer chemischen Uuntersuchung des Sandes an der Mittelmeerküste Pälastinas. *Zeitschrift der jüdischen Gesellschaft für Landeskunde und Archäologie Palästinas,* Vol. 1, 2-4, 148. (Hebrew). Jerusalem, 1925.

The results of the analysis was first published in Volume 9 of the "*Economic Data of the Department of Commerce and Industry of the Zionist Executive*" in Jerusalem. It includes the analysis of 187 samples of sand of the dunes along the coast of Palestine between Ras Nakura and Rafa.

The author finds a relation between the sand and the rocks from which sand is formed, a relation which was to be expected. The conclusion that the sands in the south of Akko contain more silicates and less chalk and ferric acid is in perfect harmony with the opinion in ancient history to the effect that in this region the Phoenicians manufactured glass. Tyre and Sidon are situated at a small distance from Akko but the soil in the immediate neighbourhood of these towns is not suitable for glass manufacture. REURENBERG.

The Effect of Iodine on Soils and Plants.

BRENCHLEY Dr. Winifred E. *Annals of Applied Biology,* XI, pp. 86-111. 1924.

In pot cultures iodine in NaI solution in quantities of 0.1 to 0.0008 gm. per kg. of moist soil has been shown to affect the germination and growth of tomato (*Lycopersicum esculentum*), mustard (*Sinapis alba*), and barley (*Hordeum*) to slightly varying degrees. Germination of tomato seeds in rich soil was not affected, but loss of seedlings from "damping off" was not reduced.

Germination of Mustard was inhibited or checked by the higher concentration; of the plants that recovered some gave greater green and dry weights than the untreated plants. Barley was less resistant to any toxic action of iodine.

Bacterial numbers fluctuated, but in no definite direction, and there was no evidence of partial sterilisation with dressing of iodine in NaI solution in quantities of 0.00095 gm. per kg. of moist soil.

P. H. H. GRAY.

Soil Acidity and its Relation to the Production of Nitrate and Ammonia in Woodland Soil.

CLARKE, G. R., *Oxford Forestry Memoirs,* No. 2; p. 27, 1 plate. Oxford, 1924.

The production of nitrate in the soil is essentially a process of biological oxidation, which takes place in three stages: the decomposition of organic matter for the supply of ammonia; and the oxidation of the latter into nitrous- and of the last-mentioned into nitric acid. It is generally

held that the formation and subsequent accumulation of nitrates in the soil is in some way related to the scarcity of acidity in the soil itself.

The tests made by the author in woodland soils show that in reality soil acidity has a certain influence on the accumulation of ammonia and nitrates. The former accumulates much more in very acid soils than in slightly acid or neutral; in very acid soils however it is liable to rapid fluctuations; the soil has the greatest power of retaining ammonia under certain conditions of moisture.

Nitrates are found in appreciable quantities in very acid soils and are apparently unaffected by seasonal changes. In less acid soils they tend to reach a minimum towards August They do not vary to any extent during the day. A. F

The Necessity for Improvement in the Chemical Analysis of Agricultural Soils.

MARCHADIER and GOUJON. De la nécessité d'une évolution dans l'analyse chimique des terres arables. *Annales de la Science agronomique*, I, pp. 32-64. Paris, 1925.

After having made general observations concerning micro-organisms and parasitism in relation to chemistry the authors compare the methods of analysis by solvents

As regards potash in particular, the analysis of 16 different soils demonstrate that the quantities required for treatment with hydrofluoric acid and with nitric acid vary from 1.3 to 10, which makes it almost impossible to compare results. Investigations on soil reaction show satisfactorily the amount present of lime and magnesia. But the acidity only appears at the rate of less than 1 per 1000 in relation to the base where iti s necessary to add lime at the rate of 5 per thousand

According to the authors the relation between phosphoric acid, nitrogen and potassium should be expressed as follows:

$$\frac{N + P_2O_5}{K_2O} = 0.8$$

Also the relation chalk soluble in HNO_3 magnesia soluble in HNO_3 should be equal to, or higher than unity.

Very little is knowns about silica, aluminium and iron in this connection

The sulphur content in soils varies very much.

In regard to the function of manganese, the authors have come to no definite conclusions.

The formula $\frac{\text{total } K_2O}{\text{total } Na_2O}$ is always higher than unity.

This work show the great progress that has been made in the study of the practice of agriculture. PIERRE LARUE.

Biochemical Studies on the Acidity of Forest Soils.

NEMEC and KVAPIL. Biochemische Untersuchungen über die Azidität der Waldböden. *Veröffentlichungen des Landwirtschaftsministeriums*, No .. Prague, 1923.

Having determined the effective and exchangeable acidity (by the colorimetric method of MICHAELIS) and the catalytic power of different forest soils, the authors have come to the following conclusions :

(1) The soil of a dense, evergreen forest shows a greater acidity than a deciduous forest of the same region. The degree of acidity of the humus layers of soil under closely wooded conifers is always higher than that of the mineral layers underneath.

In thickly wooded deciduous forest the degree of acidity of the layers of mineral soil is rather high. The P_H of the mineral soil is greater than that in the corresponding layers of humus.

(2) In woods thinly covered with evergreen trees the humus or the upper layers of the soil show less acidity than that of the corresponding strata in the thickly wooded forests of the same character in the same region.

(3) The humus or vegetal soil in the thinly covered forests of deciduous treed show less acidity than the corresponding beds in the thickly wooded forests of similar species. The mineral sub-soil of thinly covered coniferous woods has about the same degree of acidity as that of thickly wooded forests of non-deciduous trees.

The mineral subsoil of thinly covered forests of deciduous trees is less acid however than that of densely-covered forests of the same kind of trees.

(4) In cases of forests which consist partly of non-deciduous and partly of deciduous trees the humus soil always shows a P_H lower than the corresponding strata of purely coniferous woods. The degree of acidity of such soils is about the same as that of thinly covered coniferous forests or that of dense forests of deciduous trees. The mineral subsoil of mixed forests (non-deciduous and deciduous trees) had less acidity than the humous soil that covers it. The latter is also less acid than the humous strata of purely acicular forest and sometimes has a lower degree of acidity than forests consisting only of deciduous trees

(5) The lower degree of acidity of the humous and mineral soils when conifers are mingled with other types offers more favourable conditions to the micro-organisms of the forest. For this reason the biological process of mineralisation proceeds more easily in the soils of mixed forests.

(6) The degree of acidity of the layers of soil vary continuously during the year, in this respect, that the P_H is higher in the autumn than in the spring.

(7) The catalytical power depends on the presence of organic matter. The intensity of this reaction has a certain relation to the degree of acidity as well as to the number of micro-organisms in the soil.

L. SMOLÍK.

Application and Significance of Electrometric Titration for the Determination of the Reaction of Soils.

NIKLAS, H. and HOCK, A. Anwendung und Bedeuting der elektrometrischen Titration bei der Reaktionsbestimmung unserer Böden. *Zeitschrift für angew. Chemie*, XXXVIII, 195. 1925.

To judge of the soil reaction, the actual acidity (hydrogen-ion concentration) as well as the potential acidity (total or titration acidity) must be determined. This latter is established, as is well known, by titration on the DAIKUKARA method or one of its modifications, while the former is ascertained by the electrometric or colorimetric method. For an exact study of the soil reaction, next to determination of the sizes of the soil fractions, knowledge of the buffer action is important. The azotobacter method gives an approximate idea of the content of the soil in buffer-action, such method being the biochemical expression of the buffer-action of the soil, which is measured with precision by means of electrometric titration. This process is carried out in the following way : the soil reaction is ascertained by means of an electrometer, and the modification of the existing acidity controlled by adding exactly known quantities of acids or alkalis, after which the added quantities of acids or alkalis are marked on the abscissae and the corresponding values for P_H on the ordinates of a graph and the respective titration curves drawn. If a soil with exchangeable acid is agitated with potassium chloride, there is formed, as is to be expected according to KAPPEN, aluminium chloride, which gives with electrometric titration a typical series of curves. The majority of the acid mineral soils gave, on electrometric titration of their potassium chloride extracts, curves which indicate the presence of aluminium chloride and consequently exchange acidity, while forest soils show a completely different series of curves, because in their case the acidity is caused by humic acid and phosphatic acids. To carry out the electrometric titration, 50 gm. of soil are agitated with 125 gm. of 7.5 % KCl solution for half an hour; after decantation has been effected 10-20 cc. (of the solution) are pipetted, and this treatment is repeated. The authors recommend the use of the universal indicator prepared by themselves, with a view to establishsing an important point, viz. how much alkali should be added, so as not to cause too great divergences in the curve. If the turbid decantation residue is used, the electrometric titration becomes more difficult ; with sandy and light soils it is still practicable, but with heavy clays and loams it becomes quite impossible on account of the fouling of the electrodes by the soil colloids. K. SCHARRER.

Electrometric Filtration and the use of Quinhydrone.

NIKLAS, H. and HOCK, A. Die elektrometrische Titration unter Verwendung von Chinhydron. *Zeitschrift für angewandte Chemie*, XXXVIII, 407. 1925.

The investigations of the authors showed that the quinhydrone electrode may be successfully employed up to P_H 8 for determination of soil reactions.

The values found are useful and in conformity with those obtained by the use of the hydrogene electrode. The quinhydrone-electrode may also be used successfully in electrometric titration. K. SCHARRER.

Studies on Base Exchange in Rothamsted Soils.

PAGE, H. J. AND WILLIAMS, W. *Trans. Faraday Society*, XX, 573, 1925.

The Rothamsted soils which have been manured in the same way since 1843 (Broadbalk) and 1856 (Park Grass) show in an accentuated form the effects of basic exchange.

On Broadbalk where potash has been supplied, exchangeable potash is higher than on plots receiving no potash. Values for exchangeable Mg are smaller, for Na and NH_4 very little. After accounting for K removed by crops and drainage the exchangeable K, in soils receiving K exceeds the exchangeable K in soils not receiving K by only a fraction of the amount known to have been supplied. There is reason for supposing that this potassium can change into a non-exchangeable form.

The soils in question contain about 3 % chalk. Considering the ratio of exchangeable Ca, Mg and K to total exchangeable base, Ca is highest and has maximum value in soils receiving no manure or only NH_4 salts and Na salts. Next in order come soils receiving K and lowest are those receiving Mg. Farmyard manure increases amounts of total exchangeable base. Variation of absorption capacity is due to two factors.

(I) Total exchangeable base increases with increase in quantity of clay and fine silt II.

(II) Organic matter is approximately twice as effective an absorptive agent as clay and fine silt II.

On Park Grass soils the effect of liming on the quantity of exchangeable base is very marked. Exchangeable Ca increases with increasing P_H. Saturation for Ca is reached at a point where 1 % of chalk is added to a mixture of soil from the limed and unlimed portion of a plot receiving complete artificials. The HISSINK method of determining exchangeable base is not suitable for soils containing chalk, because of the absorbed H ions in the presence of NaCl solution. The difference between the basic exchange definition of " Saturation " and RAMANN's definition is discussed. T. E.

Base Exchange in Relation to the Problem of Soil Acidity.

ROBINSON, G. W. and WILLIAMS, R. *Trans. Faraday Society*, XX, 586, 1925.

Lime requirement is a conventional determination with no constant correlation with practice. Acidity is due to the presence in the soil of complex alumino-silicic acids, humic acids and their salts. According to the degree of acidity or desaturation with respect to base, the free acid rather than the salt phase preponderates.

Most lime requirement methods measure degree of desaturation.

On some Welsh soils devoid of $CaCO_3$, a high degree of unsaturation for Ca is accompanied by fertility and unresponsiveness to lime. All such soils show considerable amounts of exchangeable Ca by the HISSINK method.

Soils responding to lime show very small exchangeable Ca content. Response to lime is a function of actual exchangeable Ca rather than a saturation deficit. Exchangeable Ca is approximately proportional to Ca availability when the latter is measured by extraction of Ca by dilute CO_2 solutions. This generalisation only applies to the soils of low clay content and high exchangeable Ca content. The distribution of soils in Wales shows those of low exchangeable Ca to be upland soils subject to severe leaching and those with high exchangeable Ca content to be the valley soils. T. E.

The Relation between the P_H Value, the Lime Requirement, and the Thiocyanate Colour of Soils.

SAINT, S. I. *Trans. Faraday Society*, XX, 594, 1925.

Comparable data for a series of soils are given for: (I) P_H measurements by the quinhydrone electrode, (II) HUTCHINSON and MACLENNAN lime requirements, (III) a standardised thiocyanate determinaition. A general connection between the three is displayed. The correlation improves if the soils are divided into a light and a heavy group. The heavy soils give greater absorbing surface and absorb more base in lime requirement determination, but do not necessarily give correspondingly darker thiocyanate colour. Organic matter increases lime requirements without corresponding increase in thiocyanate colour. Colour is influenced by the amount of iron present.

Data are given for similar light soils with different thiocyanate colour but same $P._H$ lime requirement and titrateable acidity in thiocyaate extract, and for a light and heavy soil with differing colour and P_H values but same lime requirement and titrateable acidity in the extract. T. E.

Cause and Nature of the Transformation of Lime in the Soil.

SCHEFFER FRITZ. Uber die Art der Umwandlung des Atzkalkes im Boden und ihre Ursachen. Inaugural Speech at Göttingen, 1925.

The author shows by his analytical experiments, that the transformation of CaO into $CaCO_3$ does not take place quantitatively but that a part of the CaO enters into other combinations. The quantity of CaO that does not change into $CaCO_3$ depends upon the various absorbing chemical agents that are found in the different soils The principal absorbing agents are silicic acid gel and the gel mixture SiO_2-Al_2O_3. The combination of CaO and SiO_2 gel are facilitated also by the $CaCO_3$ which is already decomposed. The above experiments tend to correct the results obtained by LOHMANN on the same subject. HELLMERS.

Quantity and Nature of the "Black Substance" in certain Moravian Soils.

SMOLÍK, L. *Zemědělsky Archiv.* Prague, 1924.

The author has made use of the American method for the determination of the "black substance" (washing the soil with 1 % HCl and extraction with 3 % NH_3. The results lead to the following conclusions:

(1) The content of the black substance varies in the soils of Moravia from 0.718 to 2.598 % in the cultivable soil and from 0.211 to 2.75 % in the subsoil.

(2) In the cross section the black substance generally increases at lower levels until it reaches a maximum after which it diminishes rapidly. It may therefore be the case that the subsoil contains a larger quantity of the black substance than the cultivable soil above.

(3) The colour of the black substance in the above mentioned section is darkest in the layer of cultivable soil and gets lighter and lighter as the depth increases and becomes finally light yellow. The soil sections of more arid climates show exceptions to this rule. In these the lightest colour was to be found immediately under the upper layer of soil. The colour of the black substance from the limy cultivable soil of more arid climates was darker than that of similar soils from regions with a wetter climate.

(4) The amount of humus varies from 12 to 67.8% of the total of humus soil.

(5) The quantity of these substances also increases to a certain depth after which it decreases. In this respect the maximum of black substance does not correspond however to the maximum of the humus material in the soils.

AUTHOR.

Soil Biology.

Soil Analysis by Means of Bacteria.

CHOUCHACK, D. Analyse du sol par les bacteries. *Comptes rendus Académie des Sciences*, No. 22, pp. 1842-1844. Paris, 1924.

The author has made use of the catalytical action of soil bacteria on water saturated with oxygen. This action is due to the organisms and also to the mineral substance in the soil.

In order to determine the part that these mineral substances have in the catalytical action, the reaction is examined before and after boiling, which kills the bacteria.

By adding nitrogen, phosphoric acid, potassium, alone or in combination, the catalytic decomposition of the water saturated with oxygen makes it possible to ascertain which is the element present in the minimum proportion, which knowledge can be used in subsequent experiments.

PIERRE LARUE.

Partial Sterilisation of Soil by Antiseptics.

MATHEWS, ANNIE, *Journ. Agr. Science*, XIV, pp. 1-57, 1924.

"Quantitative determinations have been made of the effect on soil protozoa and bacteria of various antiseptic substances, including benzene and its homologues and derivatives, carbon disulphide, formaldehyde, and chloropicrin. It was found that nearly all of the substances disappeared from the soil fairly quickly, and at the same time bacterial numbers fluctuated... the process was much slower in field soil than in the richer greenhouse soils.

The increase of the bacteria during the early days varied in the same direction as the molecular weights and heats of combustion of the antiseptics, and is attributed to the latter property".

The author concludes that the rise in the number of bacteria is largely due to the bacteria feeding on the antiseptic.

In an appendix are given tables showing relative stability and the amounts of the various compounds found to be effective in inhibiting or destroying protozoa, eelworm (*Heterodera*) and fungi, in relation to their effect on bacterial numbers. P. H. H. GRAY.

Preliminary Investigations on the Relationship of Protozoa to Soil Fertility with Special Reference to Nitrogen Fixation.

NASIR, S. M. *Annals of Applied Biology*, Year X, pp. 122-133, 1923.

In artificial culture media, and in sand cultures, with mannitol, more nitrogen was fixed by free N—fixing bacteria in the presence of protozoa than in their absence. The percentage gain over nitrogen fixed by bacteria alone varied from 8 % to 28 % in artificial media with different species of protozoa or mixed faunas, and reached the following figures in sand cultures.

	Maximum figures of N. fixed % gain over bacteria alone.
Bacteria with Ciliates	36
» » Amoebae	25
« » » and Ciliates. . . .	19.4
» » » and Flagellates .	2.7

Out of 36 experiments made in duplicate or triplicate, 31 showed a positive gain. P. H. H. GRAY.

Protozoa from the Soils and Mosses of Spitzbergen.

SANDON, H. *Journ. Linnean Soc. Zoology*, XXXV, pp. 474-475. 1924.

Three samples of mud, 8 of soils, and 15 samples of mosses, collected by the Oxford University Expedition to Spitzbergen, 1921 and 1922, were examined qualitatively for Protozoa, which were found to consist of types generally met with in temperate soils. The severity of climate

appears to result not in the occurrence of local species, but in elimination of the less adaptable forms. Many forms found in tropical soils are identical with some occurring in Spitzbergen.

P. H. H. GRAY.

Soils and Vegetation.

The Forestery Value of the Sands of the Dunes and of Sandy Soils in General.

ALBERT, Der waldbauliche Wert der Dünensande, sowie der Sandböden im allgemeinen. *Zeitschrift für Forst- und Jagdwesen,* Year, XLII. pp. 120-139 (from the Laboratory for Soil Science of the Forestry School of Eberswalde).

The usefulness of the method adopted by ATTERBERG for the valuation of sandy soils has already been indicated in an earlier publication by the same author, in which he wrote upon the deep diluvial sands of the forests of Lieberosen (*Zeitschrift für Forst- und Jagdwesen,* Jahrg. 56. p. 193).

In the present article, the author examines particularly sand from the Dunes of the State Prussian Forests of Bienenthal by the use of the ATTERBERG method. It was surprising to find that these sands were not nearly so regular in respect to the size of their grains as had hitherto been supposed. The detailed table in his article shows, that not only the single sandy soils, but also the various layers of each cross section have grains of different size. Coarse sand (over 0.2 mm.) is found at a rate of 43 to 97 %. ATTERBERG states that sand must not be under 0.2 mm. in order to allow water to pass through. This condition is of course very important for the fertility of the soil. In other words the natural value of sand depends upon the percentage proportion of the constituents of soil that consist of particles of a diameter over 0.2 mm., and those parts consisting of smaller particles.

It is therefore possible to divide the sands of the Dunes within the same region into 5 types taking as a bassis the percentage of fine sand in each group for each type (under 10 %, 15 %, 20 %, etc.). These types of sandy soils are characterized by definite flora which is significant for each type. For instance, soils of the IVth type (30 % of fine sand) support rbeech trees and pines in about equal numbers. GROSSKOPF.

23. **The Influence of the Amount of Nutritive Substances and of the Soil Acidity on the Growth of Trees in the Flottlehmgebieten of Syke in North-West Germany.**

GANSSEN R., and GOERZ G. Der Enfluss des Nährstoffgehaltes und der Azidität des Bodens auf das Wachstum der Holzarten im nordwestdeutschen Flottlehmgebiet von Syke. *Second provisional report of the Laboratory of the Prussian Geological Institute,* Vol. 5. Berlin 1925.

In connection with the results of the chemical investigations carried out in the same region, the authors state that GOERZ by determining the elative conductibility obtained data that allow a valuation to be made of

the amount of soluble nutritive substances in the soil. Dr. LIESE of Eberswalde suggests the application at the same time of a method of investigating the conductibility of the sap by the use of a special electrode. This enables a valuation to be made of the different degrees of growth and shows the difference of growth in relation to the amount of nutritive substances soluble in water.

Numerous estimations have been grouped into a table, approved by a specialist in forestry which offers a means of valuation of the growth of the total forest. The table states besides the data for acidity of the soil, relative conductivity of the soil, relative conductivity of the sap, all of which factors have been classified in relation to the various timber species. The influence on the growth of the trees of the amount of nutritive substances soluble in water, is clearly seen in the data for conductivity of the soil and more so in those which determine the conductivity of the sap. It is also clear that the energy of growth of the tree, which is expressed as conductivity of the sap greatly depends upon its location. GOERZ.

Effect of Soil Alkali on Plant Growth.

HARRIS, F. S.

Results of over 18 000 determinations on tbe effect of alkali in the soil on the germination of seeds and the growth of plants were presented. From these data the following conclnsions were drawn:

The effect of the various alkali salts in soils on plant growth and the quantity of alkali that must be present to injure crops, are of great practical importance to farmers in arid regions, as well as of considerable interest to the scientist.

Only about half as much alkali is required to prevent the growth of crops in sand as in loam.

Crops vary greatly in their relative resistance to alkali salts, but for the ordinary mixture of salts the following crops in the seedling stage would probably come in the order given, barley being the most resistant: Barley, oats, wheat, alfalfa, sugar beets, maize and Canada field peas.

Results obtained in culture solutions for the toxicity of alkali salts do not always hold when these salts are applied to the soil.

The percentage of germination of seeds, the quantity of dry matter produced, the height of plants, and the number of leaves per plant, are all affected by alkali salts in about the same ratio.

The period of germination of seeds is considerably lengthened by the presence of soluble salts in the soil.

The anion, or acid radical, and not the cation, or basic radical, determines the toxicity of alkali salts in the soil. Of the acid radicals used, chlorine was decidedly the most toxic, while sodium was the most toxic base.

The injurious action of alkali salts is not in all cases proportional to the osmotic pressure of the salts.

The toxicity of soluble salts in the soil was found to be in the following order: Sodium chloride, calcium chloride, potassium chloride,

sodium nitrate, magnesium chloride, potassium nitrate, magnesium nitrate, sodium carbonate, potassium carbonate, sodium sulphate, potassium sulphate and magnesium sulphate.

The antagonistic effect of combined salts was not so great in soils as in solution cultures.

The percentage of soil moisture influences the toxicity of alkali salts.

Salts added to the soil in the dry state do not have so great an effect as those added in solution.

Land containing more than about the following percentages of soluble salts are probably not suited, without reclamation, to produce ordinary crops. In loam, chlorides, 0.3 per cent.; nitrates, 0.4 per cent.; carbonates, 0.5 per cent.; sulphates, above 1.0 per cent. In coarse sand, chlorides, 0.2 per cent.; nitrates, 0.3 per cent.; carbonates, 0.3 per cent., and sulphates 0.6 per cent. H.

The Cultivation of Corn, Weed Control and Moisture Conservation.

The Illinois Experiment Station Bulletin No. 259

The principal object and greatest value of corn maize cultivation on Brown Silt Loam is the destruction of weeds. Weedy corn probably suffers more from a lack of nutrients than from a moisture deficiency. The depth and frequency of the cultivation of corn should be determined by the weed growth.

Deep cultivation of corn may result in root injury and decreased yields in comparison with shallow cultivation. The effect of excessive and deep cultivation seems comparable to that of actual root pruning. Proper cultivation should kill the weeds with minimum injury to the corn roots.

The need for cultivation seems to be no greater in dry than in wet years; it may, in fact, be less. However, on heavy soils which work badly, cultivation may be necessary in order to fill the large cracks and thus stop the direct loss of moisture from the deeper strata.

The data and brief discussions presented in this bulletin are intended to be of assistance in developing the principles underlying the successful cultivation of corn and are not intended as recommendations of specific methods or particular implements.

D. C. Wimmer and M. B. Harland.

Regional Soil Science.

The Nature of the Rocks and Soil of the Upper Layers of Soil in the Kursk District (Russia).

Afanassieff, Prof. J. N.

(1) The slightly irregular geological formation of the Kursk District is due to the fact that this elevated plateau, which belongs to the middle Russian hills, has been untouched by the Greater-Scandinavian Glacier.

The redeeming feature of this District is the entire absence of moraine deposits.

(2) The original rocks that lie on the surface in the Northern part of the District (about as far as the river Sseim) form Cretaceous groups — marly wacke (Opoka, marl from which the chalk has been removed by silicic acid), marl, chalk.

The Southern half of the district is composed of sands of the Tertiary System and of clay soils of a loamy and sandy character belonging to the stratum of Poltawa-Charkow. The Post-Tertiary sands are also to be found occasionally in the Northern part of the District.

(3) Over a considerable surface of the territory in question the mother rocks are covered with a layer of deposits belonging to the IVth period. These layers have a maximum thickness of 12 metres and form the natural area for agriculture. They are composed of the following horizontal strata (from the surface down):

Fourth Period:

Stratum where the loess plateau is being denuded; surfaces which are being washed away along the slopes of the lowlands; deposits of the terrace slopes of the rivers.

Third Period (alluvial):

1. Loess, nutbrown loam to a depth of 2 metres.
2. Loess, sandy loam, dull yellow to a depth of 3 metres.
3. Loess-like sandy loam, chestnut brown.

Second Period (lake alluvial):

4. Inundated soil, marsh meadow soil.

4. A. Loess-like loam, yellow to dark-brown.

4. B. Sandy loams and clays sometimes loess-like, sometimes coarsely sandy, loamy sands and sands.

First Period (river glacial period).

5. S. Inundated, marshy meadow soil.

5. A. Dark brown loam with rubble and boulders from marl.

6. A. Rubble stones and residues of rocks of Cretaceous Period.

7. A. Cretaceous groups, marly wacke, marl and chalk.

5^1-B. Large sandstones.

5-B. Coarse sands with gravel and boulders of the mother rocks, rare crystal stones.

7-B. Formations of Tertiary System grey sands, and glaucous sands.

Note 1. The different kind of strata sub letter "A", are regions where the deposits of the 4th period have a substratum of Cretaceous formations; those under letter "B" have a sub-soil of Tertiary formations.

Note 2. It has been possible to show that each period had 3 phases: (1) an accumulative phase in which the stones were deposited; (2) a stationary phase, in which upon these stones the ancient types of soil formed themselves, and (3) the erosion phase when the soils and stones were inundated.

These phases were demonstrated by characteristics of the middle strata of inundated soils and furthermore by the stones that form a limit betwen the two phases. These stones are frequently brought to the surface in the steep forests on the right side of the river and on the slopes in the south and the west of the country.

(4) With regard to the general topographical aspect of the Kursk District :

It is a region that is sharply divided by numerous gorges and indentations. These divisions are remarkable for their great age and depth, and the predominating feature of the surface in this district is steep slopes. The elevated embankments of the watersheds are generally circular ridges with a diameter of about 150 Fade (300 metres).

(5) An efficient drainage of the watersheds and of a great part of the slopes is required as otherwise the steep slopes would render the country unfit for agricultural purposes.

In different places at a low level, underground water-courses were formed which acted as a drainage system, and in consequence formed moist soils upon the slopes.

(6) The moisture and the rise to the surface of the original stones at certain points along the slopes, and their lateral developments, together with the level tracts along the rivers, served in a primeval age as roads and as land suitable for the development of forests on the originally bare steppes of the Kursk district This perpetual struggle for existence between forests and steppes has caused the formation of the Kursk Forest steppe. These Forest steppes are a peculiar formation which covered in places the originally monolithic steppes, like a carpet with beautiful designs, in some places compact masses of forests, in others merely strips and groups of coppices.

(7) The upper stratum of earth which forms the soil in the district of Kursk is in accordance with the above described historical and natural conditions. In the whole region the " Black Earth " (Tschernosem) is predominant. This is the most ancient type of earth and is a product of the period of the formation of the steppe. As the forests covered the steppes the black earth suffered a degradation. The results of the various degrees of transformation of black earth under the pressure of the woods are the following types: (1) Degraded black earth as the first product of transformation ; (2) forest soils in various degrees : (3) podsol soils.

(8) These 4 types of soils may be devided as follows in regard to the hydrographical formation of the region and its general topographical character: (1) The Northwestern part of the District forms a region where forest soils predominate with small areas of degraded black earth ; (2) The Northeast and the East (as Southern limit the river Sseim) a complex of degraded and pure black earth with small areas of forest soils and finally, (3) the South and South-East of the District predominating normal black earth, with certain places showing degraded black earth and various forest-soils.

(9) In order to give a definition of each type of soil in regard to

the topography of each region the following scheme may be used: the river plains and slope soils are composed of dark coloured meadow lands, sandy terraces and plains that are not exposed to inundation and the edges of the slopes (those that are moist from the leaching of water) or the mother rocks that obtrude from the side slopes all form strips of podsol soils. Higher up and at a greater distance from the rocks, forest soils are found that gradually pass over into degraded black earth and this in turn merges into normal black earth.

In the case where woods cover the steppes near to the side slopes, or when the plateau has suffered a considerable depression, the division of the soil presents itself in the following manner: Very deep down the soil presents a very decomposed condition which gradually, in layers, merges into normal black earth as the surface is approached.

(10) Due to the breaking up of the loess plains into deep and large slopes the micro-relief of the Kursk district shows very few small depressions. In the lower areas of the watersheds there are moist meadow lands.

(11) For the same reason mentioned in the first part of (10), that is the breaking up of the loess plain into deep and long slopes, the marsh is not represented in this District, nor is the salty earth which is always found in connection with marshes on the watersheds and on the slopes.

In the South and the South-East of the District the dark coloured soils also contain salt soils which have deposits of carbonate on the surface. These soils therefore may be considered as a climatic and geological bounary.

(12) In this District the "Stolptschatye Solonzy" (Salt deposits in columnar layers) are not found. These lands are characteristic of East and South-Eastern European Russia as an accompanying phenomenon of the Black Earth complex. Only in the above-mentioned South-East and Southern corner of the District salt formations have been discovered. These "Stolptschatye Solonzy" have not been found in the District of Tschernigow, but in the Woronesch District they exist in great quantities.

This fact together with other characteristics causes the author to suppose that a climatic boundary passes through the District of Kursch. East of this boundary the characteristics of a continental climate greatly increase, in the form of recurring periods of great aridity. West of the boundary however the mildness and humidity of the climate increases and makes it more like our Western climate which is not subject to injurious periods of aridity.

THE AUTHOR.

The Soil of Russia and the Surrounding Regions.

GLINKA, K., S. 1-348. Moscow-Leningrad, 1923.

The book contains a detailed description of the soils of pre-war European and Asiatic Russia, from a morphological, geographical and topographical point of view. In the Preface the author describes the processes of soil formation and the various types of soil; he then proceeds to a de-

scription of the level zones of Russia (tundra-zone, forest-zone, steppes-zone and the zone of deserted steppes), with their climate, vegetation, original rocks and soils. The author gives a similar survey of the vertical soil-zones of the Krim, the Ural, the Caucasus, Altai and Turkestan. The last chapter treats of the ancient and fossil soils of Russia.

The author.

An Agronomical and Scientific Examination of the Soil in the Welwarn District.

JANOTA, R.: Agronomisch-bodenkundliche Untersuchung des Bezirks Welwarn. *Publikationen des Zentralkollegium des Landkulturrates f. d. Königreich Böhmen*, Vol. 8, map scale 1 : 25,000. Prague, 1923.

This soil research work was begun by Professor KOPECKY and finished by JANOTA. Prof. KOPECKY has described the work in Volume 4 of the same review. An area of 217 km² has been closely examined; 2550 mechanical, 780 physical and 520 chemical analyses have been carried out for this investigation.

The leading Bohemian soil science specialists have taken part in this excellent work, particularly Prof. KOPECKY, who initiated it, RITZNKA, R. JANOTA, etc. The volume contains 216 pages and describes the soil research work carried out in the laboratories of Czechoslovakia.

The introduction draws attention to the necessity for scientific soil research. A description is given of the methods hitherto adopted and an explanation of the map. In the third part the characteristics of the soil are described, the climate, geological conditions and the scientific conditions. The work closes with a chapter on the production and manuring of the various soils and a chapter on the necessity of marling light soils.

The detailed descriptions of each type of soil form the largest part of the book.

As in the case of KOPECKY's book (1908) this work is also full of valuable practical experiences in the field of soil science. This book should be read by those interested in the progress of this science in Czecholovakia.

L. SMOLÍK.

Chalk in Lettonia.

ROZENSTEINS S. and LANCMAINIS Z. (in Lettish with a short summary in German). 50 pages, 20 photographs, Riga, 1924.

The authors mention 80 places where chalk is found. Some of these places have been thoroughly studied; the percentage of tufa chalk was determined and chemical analyses were carried out.

The authors divide these deposits into 2 group: 1) loose and grainy deposits; 2) hard stony deposits (tufa chalk). The last group has received special attention, because this kind of deposit can be useful for technical and building purposes. The microscopical structure has been studied and the technical characteristics of tufa chalk and photomicrographs have been taken.

Tufa chalk may be easily worked with saws and adzes while in humid condition, has a great resistance to weathering and is very adaptable for facades, statues and as building material in general.

From a point of view of chemical composition the samples examined represent a relatively pure $CaCO_3$ without $MgCO_3$; some samples show an addition of $CaSO_4$ and of $FeCO_3$.

Often the deposits of tufa chalk show remains of plants, leaves and shells.

The study of these deposits may therefore produce very interesting data for the study of the characteristic climate and the flora of the period after the glacial epoch.

The numerous deposits of chalk in Lettonia — (which are far more numerous than indicated in the above mentioned work) — are also of great importance for the chemical industries that require pure $CaCO_3$, and they are useful for the improvement of podsol soils.

L. Frey.

Agricultural Conditions in Palestine.

Sawyer, E. R. (Director of Agriculture). A Review of the Agricultural Situation in Palestine. Department of Agriculture and Fisheries, Palestine, 1923. (Price 10 Piastres).

This work contains statistical material in addition to a large number of scientific articles, and gives a summary of the agricultural situation of Palestine during the year 1922. A communication by Sir William Willcox " Extracts from a Report on the Irrigation of Sania Lands in the Jordan Valleys " speaks very favorably of the possibilities of cultivation and irrigation in this district, which lies between the Lake of Tiberias and the Dead Sea. The soil appears to have plenty of phosphates and lime. Data are given respecting the total amount of soluble salts of 9 different soils that have been analysed.

In Part IV it is stated that about half a million hectares are already cultivated and another 300,000 hectares are ready for cultivation.

Twelve soil analyses are given, and concern principally soils of the plain, near the coast and the mountains of Judea. Some of these soils have been chosen in order to present typical examples of soils suitable for tobacco planting, wine, oranges, almonds and sugar cane. As is to be expected in a semi-arid region, these soils are generally poor in nitrogen and rich in soluble salts.

Most of the analyses were made by the State agricultural and chemical laboratory in addition to two analyses by M. Vinik, which have been already published in " Der Boden Palästina's " by Blansenkhorn.

Reifenberg.

The Soils in the Drina, Save and Morava Areas.

Stebut Prof. Alex. A, *Zemljista Drino-Savo-Moravska oblasti*. Published by the Ministery of Agriculture. Belgrade, 1924.

This work records the beginning of a systematic investigation of Serbian soils. The following is a summary of its contents: Introduction;

Part. I. Methods of investigation, processes of soil formation ; climate and types of soils in Europe (1-26). — Part. II. Chapter 1st : The factors which have most influence on the formation of the soils in the D. S. M. region ; climate, vegetation, deposits, original rocks (27-51). — Types of soil : Black earth called "smoniza" (smola means pitch) and its varieties ; brown earth called "gajngatscha" (gaj means grove) : podsols called "pepeljusche" and "bolówatsche" ; pasture lands called Kumsatschka, (51-96). — Chemical and mechanical analysis of some of the types of soil (97-109).

III Part. The most important agricultural characteristics of the soil-types in the D.S.M. region ; measures for their improvement (110-161). — Conclusion. (162-163). — Resumé of the text in French (164-180).

The work concludes with 6 photographic reproductions and an index.

A. SEIWERTH.

The Soils of Lettonia.

VITINS J. (J. WITYN) (printed in Lettish) 50 pages. Riga, 1922.

In a short study on soil formation the author describes the process as follows : (1) Transformation of the mineral substances and their translocation nearer to or farther from the surface. (2) Development of the humus layers and (3) Transformation of the physical qualities of the mother rock as a consequence of the change in the mineral substances. He points out the principal factors of soil formation and the most important and common mother rocks (morainic, loams and their products). The process of soil formation of heavy clay soils is described. These heavy clay soils represent about $\frac{1}{3}$ of the total territory of Lettonia and are to be found in all the different gradations of the podsol. The clays contain $CaCO_3$ at the depth of 60 to 70 cm., even when the upper layers are of a strongly podsol type. The heavy marly soils in Lettonia contain about 20 % of $CaCO_3$, which has been admixed with the clay during the glacial epoch by the Silurian limestones of Estland.

The author says that the degree of podsol depends upon the climatic conditions, principally the quantity of rainfall. The rainfall varies from 400 mm. (Bauske) to 680 mm. (Hasempoth, Goldingen). In the region of Bausken above the morainic loam, layers of ground are found that in character resemble the Tschirnosem and Rendsimen soils. Generally the $CaCO_3$ is washed out to a depth of 50 to 60 cm. In the region af Hasenpoth and Goldingen are found typical Podsol soils, though the line of demarcation also in these soils lies at a depth of 50 to 70 cm.

After studying the process of formation of the podsol soils in Lettonia, the author distinguishes 4 phases in that process.

Ist Phase : Development of an immense layer of humus (40 to 50 cm.) ; the washing out of the $CaCO_3$ only begins in this phase.

IInd Phase : The layer of humus being devoid of $CaCO_3$, the calcium ion absorbed by the humous and zeolitic parts of the soil are attacked by the washing out process. The soil contains bad physical qualities and is almost impermeable to water or roots. Few soils in this condition are found ; they very quickly change into the next phase.

The 3rd Phase shows the further washing out of the finer particles of the upper layer and its deposition into deeper layers. This is due to a greater dispersion of the soil particles. The nature of the soil in this phase is very marshy and its colour grey.

IVth Phase. The layer of humus becomes smaller, the bottom stratus becomes ashy grey and lies on a bed of thick loam ; the reaction of the soil is strongly acid. The point of " demarcation " in this phase is from 50 to 70 cm. depth, therefore little water passes into the deeper strata.

The author points out in his conclusions that there is a connection between the degree of podsol of the soils and their fertility. The production of strongly podsol type soils is 2 to 5 times smaller than that of soils in the first or second phase.

The decrease of acidity of the podsol soils is of great importance for fertility. Soils that have been very acid and in which the acid condition has been decreased produce in the same measure as non-podsol type soils. L. FREY.

Report on the Soil Survey of the Dialah Area (Right Bank).

WEBSTER, I. F. and VISWANATH, N. *Department of Agriculture Mesopotamia. Memoir No.* 2, 1921 (The Times Press. Bombay 1921). Price 1 R.

This report gives the results of soil researches in a district in which a reconstruction of the old irrigation works had been planned. The hihg percentage of salt in the soil is due to the water used for irrigation purposes. (The analysis of this water shows 70-100 parts per 100000 of soluble salts, of which 15 to 25 parts are NaCl).

Thirty three soils were mechanically analysed and subjected to a chemical analysis in respect to the principal salts and nutritive substances.

The authors came to the conclusion that if the proposed drainage system is carried out good results may be expected. REIFENBERG.

Alkali Soils in Iraq, a Preliminary Investigation.

WEBSTER J. F. *Department of Agriculture, Mesopotamia, Memoir No.* 1, 1921. Bombay, The Times Press, 1921. Price R. 1).

In Mesopotamia, as in nearly all arid or semi-arid lands, alkali or sandy soils are to be found. The author calls the vilayets of Bagdad and of Basrah arid, giving as his personal opinion however that it would be more correct to call them " extremely Mediterranean ".

During the summer the temperature risis to about 120° F. in the shade, while the humidity during that period is about 38 %. Under these conditions it is evident that a complete desiccation of the soil takes place. In winter the temperature in Bagdad is 27.5° F. and the relative humidity is 80 %. In this season there is about 5 inches of rainfall.

The author considers it of the greatest importance to take measures to prevent the soil from becoming over saturated with salt and when this condition exists, where possible, to carry out improvements.

The salts that are principally found in these regions are sodium sulphate, sodium chloride, and sulphate and chloride of calcium and magnesium, while the so-called " Black Alkali, " sodium carbonate, is not found.

It has proved to be impossible to wash away the salts by flooding and drainage; this method only drives the salts into the deeper levels of the soil, after which they return to the surface owing to capillary ascension.

Mesopotamia, which at one time was one of the most fertile countries, is in danger of becoming a desert, this condition being due to the fact that the ancient methods of drainage have been forgotten.

According to the author the only solution is in drainage by percolation, by which the salts are finally conducted into the principal drainage system of the country. This system could only be applied by the Government.

The appendix of the work contains a number of analyses, illustrating the percentage of salts and their probable compounds. The map shows the division of the Dialah District intodifferent salt areas.

REIFENBERG.

Further Studies on Alkali-Soils in Iraq.

WEBSTER, J. F. and VISWARATH, B. *Department of Agriculture, Iraq, Mémoir No.* 5, 1921 (The Times Press, Bombay 1921). Price Rs. 2.

In the first part of this book a study is made of the influence of soluble salts on the phyisical condition of the soil. The work was carried out as follows: A sample of soil was continuously washed until it was practically free of salts. At the same time the original soil was examined. Besides making a mechanical analysis, the authors studied capillary attraction, permeability, the absorption of salt solutions, hydroscopic power, pore space, degree of acidity and evaporation capacity of the soil.

In the second, part the influence of salts on saplings is demonstrated as well as the growth of young trees in naturally sandy soils. One experiment concerns the growth of saplings in soils with a variable percentage of salts but, with a constant percentage of nutritive substances. Another experiment investigates the maximum content of salts in a soil intended for wheat cultivation.

Further experiments are made on osmotic pressure and toxic influences. The investigation finally deals with sodium carbonate and the toxic effect of other soluble salts.

In Part III the authors discuss some conclusions drawn from their experiments.

Though many of the results of these experiments are not new, the work is very interesting. It is to be regretted that colloid chemistry in connection with the problem has not been treated.

REIFENBERG.

Bibliography.

General.

ARRHENIUS, O. Vad Kan Göras För Att Höja Betodlingen i Sverige Aktiebolaget Cronholms Litogr. Anstalt, Malmö 1924.

GLOMME, Hans. Jordbrunnsforskning og Jordbrunnslaere-Undervisningen. I. U. S. Amerika (Soil Investigation and Soil Science in the U.S.A.). *Jordundersokelsens smaskrist* Nr. 13. Kristiania Grondahl u. Sons Boktrykkeri, 48 S. Kristiania, 1924.

J. MARCUSSON. Torfzusammensetzung und Lignintheorie. *Ztsch. angw. Chemie*, 38, 339. 1925.

POTONIÉ, ROS and SEITZ OTTO. Geologie. *Bucherei für Landwirte* Herausgegeben v. Prof. Dr. H. v. LENGERKEN, Landwirtschaftliche Hochschule. Berlin, Walter de Gruyter & Co.

ROZENSTEINS, E. and LANCMANIS, Z Latvijas avotkalki. (Lime in springs in Lettland). Riga, 1924.

SARAKSTIJIS J. VITINS. Zemes bagatiba un augliba. *Latvijas Agronomu Biedri bas Izdevums.*

WITYN, J. Kalka trukums Latvijas zemes, vina lielums, pazimes un noversana. *Vietejie kalkosanas material.* Riga, 1924.

Soil Physics.

GRAVES J. E. and LUND, Y. The Role of Osmotic Pressure in the Toxicity of Soluble Salts. *Soil Science*, Vol. XII. No. 2, August, 1921.

HARRIS, F. S. and TURPIN, H. W. Movement and Distribution of Moisture in the Soil. *Journal of Agricultural Research*, Vol. X, No. 3. Washington, July 1917.

ISRAELSEN, ORSON W. and WEST, FRANK. The Water Holding Capacity of Irrigated Soils. Utah Agricultural College, Experiment Station, *Bulletin* 183. Logan, Utah, Nov. 1922.

KINCER, J. B. Climate of the Great Plains as a Factor in their Utilization. *Annals of the Association of American Geographers*, 13, 67-80. 1923.

LICHTENBERG, J. F. Soil Water Level, Capillarity and Evaporation. *Cultura*, Year 34, pp. 262-270. 1922.

PITTMANN, S. W. Maintaining the Productivity of Irrigated Land. Utah Agricultural Experiment Station, Logan, Utah, *Bulletin* 188, June, 1924.

RANGE, PAUL. Das Grundwasser in den Trockengebieten der Erde. *Zeitschrift f. prakt. Geologie*, Year 31, Part 10, pp. 97-112. 1923.

WIEGNER, G., GALLAY, RENÉ and GESSNER, H. Wasserbindung im Boden. *Kolloidzeitschrift*, Vol. XXV, Part 5, 1924.

WIESSMANN, H. Ueber den Einfluss des Lichtes auf die Nährstoffaufnahme der Pflanzen im Jugendstadium. *Zeitschrift für Pflanzenernährung, und Düngung* Part B. 4th Year, No. 4, Publ. by Chemie, Leipzig, Bosestr. 2.

Chemistry of the Soil.

BLANCK E. and PASSAGE unter Mitwirkung von RIESER, A. und HELDE, F. Die chemische Verwitterung der Aegyptischen Wüste. Hamburgische Universität. *Abhandlungen aus dem Gebiet der Auslandskunde*, Kommissionsverlag L. Friedrichsen & Co.

BLANCK, E. and SCHEFFER, F. Ein weiterer Beitrag zur Umwandlung des Aetzkalkes in kohlensauren Kalk im Boden und die Ursachen der Bindung des Kalkes. *Zeitschrift f. Pflanzenernährung u. Düngung.* Part B, Year 4, No. 2, Publ. by Chemie, Leipzig, Bosestr.

BJOERLYKKE, K. O. Aaraberetning for Statens jordundersoekelse i 1923. *Saertryk av Meldinger fra Norges Landbrukshoeiskole,* Nos. 2 and 3, pp. 15, 1924.

BRENNER, WIDAR. Ueber die Reaktion Finnländischer Böden. Geologiska Kommissionen I Finnland, *Agrogeologiska Meddelanden,* No. 19. Helsingfors, 1924.

DACHNOSWKI, A. P. The chemical examination of various peat materials by means of food stuff analyses. *Journal of Agricultural Research,* Vol. XXIX, No. 2. Washington, July, 1924.

A. GEHRING and O. WERRMANN. Studien über die Einwirkung des Kalkes auf den Boden. *Landw. Versuchsst.*, 103,279. 1925.

GESSNER, H. Betonzerstörungen durch chemische Einwirkungen des Grundwassers. *Schweizerische Zeitschrift für Strassenwesen,* No. 5-6. 1925.

GREAVES, J. E., HIRST, O. T. The Soil Solution. *Journal of Industrial and Engineering Chemistry,* Vol. 14, No. 4, pp. 224, March. 1922.

HARRIS, F. S. Soil Alkali Studies; Quantities of Alkali Salts which prohibit the Growth of Crops in Certain Utah Soils. *Utah Agricultural College, Bulletin* 145. Logan, Utah, Sept. 1916.

HEADDEN, W. P. Titanium, Barium, Strontium and Lithium in certain Plants. *The Agricultural Experiment Station of the Colorado Agricultural College, Bulletin* 291, April, 1924.

HEADDEN W. P. The Effects of Nitrate on the Composition of the Potato. *The Colorado Experiment Station, Agricultural Division, Bulletin* 291, April, 1924.

F. HENRICH. Ueber die Radicaktivität und neuere Untersuchung der Quellen des Taunus. *Ztsch. angew. Ch.* 38, 472. 1925.

HISSINK, D. J. De verzadigingstoestand van kleigronden, in verband met het proefveld bij den heer Dijkema, Nieuw-Beerta. *Groninger Maatschappij van Landbouw.*

HISSINK, D. J. De zuurgrad van boschgronden. Overdruk uit het *Landbouwkundig Tijdschrift,* No. 432, Sept. 1924.

HISSINK, D. J. Onderzoek van eenige baggermonsters uit Purmerland Noord-Holland.

HISSINK, D. J. Some General Conceptions on Acidity and the Role Played by it in Several Processes. *Verslagen van Landbouwkundige Onderzoekingen der Rijkslandbouw Proefstations,* No. 27, pp. 133-145. 1922.

HISSINK, D. J. A Simple and Quick Method for Determining Soil Acidity. *Chemisch Weekblad*, Bd. 19, pp. 281-283, 1922.

HISSINK, D. J. and VAN DER SPEK, JAC. The Acidity of the Soil. *Verslagen van Landbouwkundige Onderzoekingen der Rijkaslandbouw Proefstations*, No. 27, pp. 146-161, 1922.

LEMMERMANN, O. Das Wesen, die Bedeutung und die Bestimmungsmethoden der Bodenacidität. *Zeitschrift für Pflanzenernährung und Düngung*. Part A, Year 4, No. 4. Publ. by Chemie, Leipzig, Bosestrasse 2.

SCHEFFER F. Ueber die Art der Umwandlung des Aetzkalkes im Boden und ihre Ursachen. *Journal für Landwirtschaft* 72, 201, 1924.

WITYN, J. I. Die Hauptphasen des Podsolbildungsprozesses. II. Die Fruchtbarkeit des Bodens in ihrer Beziehung zur Bodenacidität. (Zusammenfassung einiger Bodenuntersuchungen in Lettland). Publ. by A. Gulbis. Riga, 1924.

Biology of the Soil.

GREAVES, J. E. and CARTER, E. G. and LUND Y. Influence of Salts on Nitrification in Soil. Utah Agricultural Experiment Station, *Soil Science*, Vol. XIII, No. 6, June 1922.

GREAVES, J. E. und CARTER, E. G. Influence of Sodium Arsenite on Microflora of Soil. *The Botanical Gazette*, Vol. 77, No. 1, March 1924.

GREAVES, J. E. and CARTER, E. G. The Influence of Moisture and Soluble Salts on the Bacterial Activities of the Soil. Utah Agricultural Experiment Station, *Soil Science*, Vol. XIII, No. 4, 1922.

GREAVES, J. E. and NELSON, D. H. The Influence of Nitrogen in Soil Nitrification. *Utah Agricultural Experiment Station, Bulletin* 185. Logan, Utah, July 1923.

HEADDEN, W. P. Fixation of Nitrogen in Colorado Soils. Occurrence of Nitrates on Rocks. *The Agricultural Experiment Station of the Colorado Agricultural College, Bulletin* 177, May 1922.

MASCHAUPT, J. G. The Influence of Soil Type and Fertilization on the Nitrogen and Ash Contents of our Farm Crops. *Verslagen van Landbouwkundige Onderzoekingen der Rijkslandbouw Proefstations*, No. 27, 1922, 10th communication,- No. 28, 1923, 11th. and 12th. communication.

WEIS, FR. Undersogelser over Jordbundens Reaktion og Nitrifikationsevne i typiske Danske Bogeskove. (Investigations on the Reaction and Nitrification Possibilities of the soil in typical Danish Beech Forests). Meddelelser fra Dansk Skovforenings Godningsforsog. Copenhagen, 1924.

Soil and Vegetation.

EHRENBERG, P., O. NOLTE, J. P. von ZYL, J. HAHN-HASLINGER, E. UNGERER, E. LUNAU, CH. PFOTENHAUER. Ueber die Wirkung der Kaliendlaugen auf Boden und Pflanze. *Landw. Jahrbücher*, 61, 473, 1925.

GANSSEN, R. and GOERZ, G. Der Einfluss des Nährstoffgehaltes und der Azidität des Bodens auf das Wachstum der Holzarten im nordwest deutschen Flottlehmgebiet von Syke. *Mitteilungen aus dem Laboratorium der Preuss. Geolog. Landesanstalt,* No. 5. Berlin, No. 4. Invalidenstrasse 44, 1925.

LEMMERMANN, O. Bemerkungen zu der vorstehenden Arbeit von Fr. DUCHON "Beitrag zur Erklärung der ertragsteigernden Wirkung der kolloidalen Kieselsäure bei unzureichender Phosphorsäuredüngung in Sandkulturen." *Zeitschrift für Pflanzenernährung und Düngung,* Part A, 4th Year, No. 5, Publ. by Chemie, Leipzig, Bosestrasse, 2.

LEMMERMANN, O. and WIESSMANN, H. Versuche mit "Asahi-Promoloid". *Zeitschr. f. Pflanzenern. u. Dü ngung,* Part A, 4th Year, No. 6, Publ.Chemie, Leipzig, Bosestr., 2.

LEMMERMANN, O., WIESSMANN, H., unter Mitwirkung von SAMMET, K. Untersuchungen über die Ursache der ertragssteigernden Wirkung der Kieselsäure. *Zeitschrift für Pflanzenernährung und Düngung.* Publ. by Chemie Leipzig, Bosestr. 2, Part. A, 4th Year, No. 5.

SHANTZ, H. L. The natural vegetation of the Great Plains. *Annals of the Association of American Geographers,* 13, 81-107, 1923.

Nomenclature, Classification and Mapping.

AARNIO, B. Mémoires sur la carthographie des sols dans divers pays de l'Europe, Amerique, Afrique et Asie. Suomi (Finnland), allgemeine geophysikalische Beschreibung. *Veröffentlicht durh den Presidenten der V. Internationalen Bodenkundlichen Kommission:* Agrogeologiska *Kartor* No. 4. Helsingfors, 1924.

AARNIO, B. and STREMME, H. Zur Frage der Bodenklassifikation und Bodenbildung. Geologiska Kommissionen I Finnland, *Agrogeologiska Meddelanden,* No. 17. Helsingfors, 1924.

RAMSAUER, BERNARD, Bodenuntersuchung und Bodenkarte des Schulgutes Oberalm und angrenzender Parzellen. Publ. by the Landes-Meliorationsamtes Salzburg. 1924.

Regional Soil Science.

BRAEUHAEUSER, M. Die geologischen Verhältnisse Württembergs in ihrem Einfluss auf die Landwirtschaft. *Mitt. d. Deutschen Landw. Gesellschaft,* No. 23. Berlin, 1925.

BRENDEL, LOUIS. Geologie und Hydrologie des Irchels. *Promotionsarbeit, genehmigt von der Eidgen. Techn. Hochaschule in Zürich.* 1923. Diss. Druckerei Gebr. Leemann & Co., A. G.

HEADDEN, W. P. A Peculiar Soil Condition in the San Louis Valley. *The Colorado Experiment Station, Agricultural Division, Bulletin* 286 May, 1923.

HISSINK, D. J. and ZYLSTRA, K. Report on the Investigation on the Causes of the Poor Appearance of Some Crops in Zealand. *Verslagen van Landbouwkundige Onderzoekingen der Rijklandbouw Proef-*

stations (Berichte über landwirtschaftliche-wissenschaftliche Untersuchungen der staatlichen landwirtschaftlichen Versuchsstationen), No. 27, pp. 1-12. 1922.

HISSINK, D. J. and BROCKMANN, Chr. The Black Clay of Thesinge (in the province of Groningen, Holland). *Verhandelingen van het Geologisch-Mynbouwkundig Genootschap voor Nederland en Kolonien. Geologische serie*, Vol. 6, pp. 43-55.

JOCHEMS, S. C. J. *Mededeelingen van het Deli Proefstation te Medan-Sumatra.* Tweede Series No. 888. Verslag van de Selectioproeven over het jaar 1921.

WITYN, J. Die Sande und die Sandböden in Lettland, (with short summary in German.) Publ. by Forstdepartment des Landwirtschaftsministeriums, Lettland.

General Information.

International Society of Soil Science. — The number of members of the International Society of Soil Science has very considerably increased n the last six months, so that the total is now 533. The list of members will appear in the next number of the Review.

Our Society has sustained the loss of one of its leading members in Professor MURGOCI, of Bucharest. The death of our friend and colleague, is a loss which is deeply regretted, not only for our Society and for the science of pedology, but also on personal grounds. MURGOCI was among those of my colleagues, who from the earliest days, that is from the first Soil Science Conference in Budapest, in 1909, took a deep interest in the progress of the Science. An appreciation of his conspicuous services will appear elsewhere in this Review.

When in May 1924 I expressed my willingness, in response to repeated requests, to undertake the work of General Secretary and Treasurer in addition to the office of Acting President, I could not suppose that this post would entail so much work. In future it will not be possible for me to devote so much time to the business of the Society. A part of the work must be undertaken by the National Sections, which in accordance with paragraph 6 of the Rules of the Society may be formed in the separate countries. My own idea is that Treasurer and the Secretaries, of these national sections, will in future assist me by making themselves responsible for correspondence with members, the collection of annual subscriptions, records of changes of address and so on, reporting to me on these points and sending me the subscriptions in a single account.

I should therefore be glad if the members would work for the formation of National Sections and report to me on the composition of the executive committees. It may be mentioned that each National Section of more than 15 members has the right to be represented by one member on the General Committee. For the present I should like to ask, (1) that members will reply at once to my enquiries, whether made by letter or circular, (2) that the

annual subscriptions may be sent to me in Dutch florins, either by Post Office Order or paid into the "Geldersche Credit Vereeniging", Groningen, (Holland) on account of the International Society of Soil Science.

D. J. HISSINK,
Acting First President and General Secretary.

Groningen, June 26, 1925.

The International Commissions. — The lists of members sent to me by the chairmen contained a whole series of names of collaborators who ar not members of the Society. It is however obvious that only members of the Society can be members of a Commission, or a Section. On the other hand it should be a matter of concern to new members to attach themselves to one or more Commissions. By agreement with the chairmen of the Commissions, therefore, all members are asked to inform me which Commission or Commissions they intend to join (See Circular of May 1925). As you may already be aware, the first Soil Science Congress will be held in May 1927 in Washington, U. S. A. The American Organising Committee, which includes Messrs LIPMAN, MARBUT, McCALL, will provide all preliminary information. The first duty of the Congress is to consider the recommendations of the International Commissions. The Chairmen of the Commissions are expected to forward these recommendations at the proper time, and to come to an understanding with the American Organisation Committee. I am always perfectly willing to act in an advisory capacity, but the Commissions must themselves regulate their activities and methods of organisation independently.

The second International Soil Science Commission has already decided to hold at Groningen in the spring of 1926, a meeting for the preliminary discussion of the questions of soil acidity and soil adsorption. A circular has been sent out by the Organising Committee to all members of the Society and also to a large number of non-members, who will probably become members. It may be mentioned that the expenses of this meeting will not be defrayed out of the funds of the Society.

The Third Commission (Chairman, Prof. STOKLASA) also proposes to meet this year in advance of the Congress. The Committee for the Soil Map of Europe met on 8 and 9 May in Berlin. Prof. STREMME was elected Chairman in place of Prof. MURGOCI. Prof. WOLFF, Secretary of this Commission, which is a Sub-Commission of the Fifth Commission (Chairman, Prof. MARBUT), will report in detail on the Berlin meeting.

D. J. HISSINK,
Acting First President and General Secretary

Groningen, 26 June 1925.

Notice of May, 1925 — The foundation subscription for the year 1924 was fixed at 2 dollars.

The subscription for 1925 has been fixed at 6.50 Dutch florins. New

members who have not paid the foundation subscription of 2 dollars pay an entrance fee of 2.50 florins.

Institutions, societies, libraries, etc., are eligible for membership as well as individuals.

Members receive the journal, edited by Prof. F. SCHUCHT, Berlin, free of cost. The journal is printed at and despatched from the International Institute of Agriculture, Rome, and appears in French, German, English, Italian and Spanish. Members are asked :—

1. to forward to me before 15 July 1925 the subscription for 1925 of 6.50 florins, in the case of new members with the entrance fee of 2.50 Fl ;

2. to send with the subscription their exact address *type-written* or *in block capitals ;*

3. to inform me in which of the five languages they desire to receive the journal ;

4. to inform me which Commission or Commissions they intend to join ;

5. to state whether they wish to obtain the Proceedings of the Fourth International Soil Science Conference (Rome, May 1924) at the reduced price of 80 French francs, the ordinary selling price being 100 francs. Members of the Rome Conference naturally receive the Proceedings free of cost.

The attention of members is called to the fact that it is absolutely essential to reply to these five queries at latest by 15 June 1925.

Dr. D. J. HISSINK,
Acting First President and General Secretary
Groningen (Holland), Hermand Colleniusstraat 25

II. **International Commission for the Study of Soil Chemistry.** — To the members of the International Society for Soil Science.

At the meetings of the Commission for the Study of Soil Chemistry held uring the Fourth International Soil Science Conference (Rome, May 1925) dhe following questions received special attention: — soil acidity, soil adsorpttion (exchangeable bases, point of saturation, etc.).

The conduct of the further study of these questions was entrusted to Dr. H. R. CHRISTENSEN and Dr. D. J. HISSINK.

A detailed preliminary discussion of these questions in a meeting of the second Commission seems to be desirable in preparation for the First Soil Science Congress which is to be held in America in May 1927. With this object the undersigned have formed themselves into a preliminary Committee and have decided to hold this meeting of the second Commission in the spring of 1926, either April or May, in Groningen. The Committee is making the following arrangements for the meeting :—

Members of the Society who are specially interested in the above questions are asked to communicate their views in connection with particular subjects in as brief a form as possible at latest by 1 November 1925 to Dr. D. J. HISSINK. The papers should be forwarded in duplicate and typed in German, English or French. It is intended to print papers in the order in which they are received. The meeting in Groningen will be given up to the discussion of these papers.

In addition members are asked to state at the same time, or at latest by 1 November 1925, whether they intend to take part in the meeting at Groningen in the spring of 1926 and what date would suit them best, either the beginning of April (the Easter holidays) or the second half of April, or the begining or end of May. It is of course understood that this communication is only preliminary and that a final decision will be asked for only at the beginning of 1926.

Although it is mainly those members who are interested in the study of Soil Physics and Chemistry who will take part in the preparation for the meeting and in the discussions, it has been considered best to send this circular to the 500 members of our Society and moreover to our collaborators, who are not yet members but who may become so. We hope that this may prove an incentive to join. It may be remarked that only members of the Society have the right to send papers and to take part in the meeting.

Budapest (Hungary)
Leeds (England)
Lyngby (Denmark)
Groningen (Holland)
May 1925.

Prof. ALEXIUS A. J. von 'SIGMOND, Budapest.
Prof. N. M. COMBER, Leeds.
Dr. H. R. CHRISTENSEN, Lyngby.
Dr. D. J. HISSINK, Groninge.n, Holland, Herman Colleniusstraat, 25.

Report of a Meeting of the Supervisory Committee for the International Soil Map of Europe on 8 and 10 May 1925 in Berlin.

The Supervisory Committee for the International Soil Map of Europe, a section of the Fifth Commission of the International Society of Soil Science, deeply regrets the death of its Chairman, Prof. MURGOCI, which took place on 5 March and cut short a life of remarkable activity and success. As a consequence of this event and in view of the necessity for carrying out the preliminary work for the Soil Map on a uniform plan and with due regard to the experience gained and the proposals made since the Rome Conference, the Secretary found it necessary to invite members, as well as other foreign experts in the subject, to a conference, as had already been suggested at the Rome meeting. As is always the case with international conterences, only a certain number of those invited could undertake the journey. There were present: Prof. STREMME, Danzig; Dr. TAMM, Stockholm; Prof. von MIKLASZEWCKI, Warsaw; Prof. TREITZ, Chief Geologist, Budapest and Prof. WOLFF, Berlin.

The first business of the Committee was to elect a chairman, who might be expected to render active support to the work in such a way as to command the confidence of all experts. On the written proposal of Dr. FROSTERUS of Helsingfors Dr. STREMME of Danzig was elected. The Committee then filled the vacancy in its numbers by electing Prof. A. TILL in Vienna, in whose company the late Prof. MURGOCI had worked out his schemes. Among the other formal decisions may be mentioned one urging that the active co-operation of the European Geological Institutes that have not so far taken part in this work should be invited, and that the International Society of Soil Science should be requested to make a contribution of 100 marks towards

the Committee's expenses in this connection, which will be later reimbursed out of the receipts from the sale of the outline map of the Soil Map of Europe. Finally on the invitation of P. TREITZ it was decided to hold a meeting in the latter part of July (1926) in Budapest, so that the local soil conditions may be inspected together with the sketch map of the Hungarian soils that has already been prepared, and that suggestions may in consequence be made with a view to ensuring a right conception of the scheme and the proper presentation of the material in other countries.

The adoption of the lines suggested by Prof. MURGOCI and the continuation of the work on the map was recommended. The difficult conditions, especially the want of recognition of pedological research in most of the countries within the sphere of operations of the Committee, make it advisable that there should appear in the first place a sketch map on the scale of 1 : 10 million, which should show only the outstanding features of the nature of the soils. The map is to represent : by hatched lines, the sandy gravels and the clay loams, and also peat and rock : by three shades of green, the types of soil which are distinguished by excess of sesquioxides (Podsol types according to the degree of saturation ; coloured violet in two shades, the types of soils which have only the upper mould (the A horizon) stained with humus (Tschernosem type) but not the B horizon with the excess of sesquioxides. As a working map the black print of the International Geological Map of Europe (1 : 1,5000,00) is recommended. The main principles of the map with the scale of 1 : 2,500,000 should first be definitely established, even if certain countries have prepared their maps on the scale of 1 : 10,000,000 as may very well be the case up to the Budapest conference in the summer of 1926. An estimate of the cost of maps with scales of 1 : 10,000,000 and 1 : 2,500,000 may be obtained from any cartographical institute, so as to give the committee and idea of the possibility of publication and the general style of the map.

W. WOLFF, *Secretary*,
Berlin, No. 4 Invalidenstr. 44.

Journal " Pédologie ". — The readers of the above mentioned paper are informed that the Journal "*Pédologie*" appears once more under the Direction of Prof. JARILOW (Moscow). This Journal deals principally with publications in the field of soil science in Russia, and contains articles and reports. The journal is published in the Russian language and in a foreign language. The subscription for the year 1925 is 6 roubles ; please apply to " User ", Moskau, Smolensky, Bulw. 57, Committee for Soil Science ; Office of the authorized representatives of the specialists in soil science of Russia.

Personal. — Hofrat (Court Councillor) Prof. Dr. Ing. agr. JULIUS STOKLASA, Professor at the Technical High School, Prague, known both as a scientist and as a man of pratical experience, celebrates the 50th anniversary of his scientific career. At the same time he has been for a quarter of a century Director of the chemical-physiological experimental Station of Prague.

Professor STOKLASA has published a great many works some of which are already considered as standard works, for instance *Der biochemische Kreislauf der Phosphations im Boden* (the biochemical series of recurrent changes of phosphates in the soil) and another called *Über die Verbreitung des Aluminiums in der Natur*. (The distribution of Aluminium in nature), etc.

Dr. STOKLASA is also well known for his studies on the biogenetic elements in the plant organism, mainly phosphorus, sulphur, iodine, potassium, and aluminium, and for his work on the biochemistry of soil. Besides this he has done some very valuable work in the field of biology and his work has been of great use to soil science.

STOKLASA is the promotor of the International Commission for Soil Biochemistry and Soil Bacteriology. As President of this Commission he has taken part in several International Congresses. His knowledge and personality have ensured him a large following of friends in his own country as well as abroad. NIKLAS.

Forest officer Dr. KRAUSS, assistant at the Experimental Station of Forestry at Munich, has been appointed "Privat-Dozent" for soil science and agricultural forestry and chemistry at the University of Munich.

Professor RAMANN, Munich, was elected foreign member of the Hungarian Academy of Science and Professor A. A. J. von 'SIGMOND, hitherto a foreign corresponding member was elected an ordinary member of the same Academy.

Professor Ing. Dr. ADOLF SEIWERTH, lecturer of the Agricultural and Forestry Department of the University of Zagreb (Jugoslavia) was appointed Professor of Soil Science at that same University.

Professor SEIWERTH has been made President of the Institute of Agricultural Chemistry at Osyek.

We expect to receive an obituary notice of MURGOCI from Prof. POTOPOPESKU-PAKE.

Dr. FRIEDRICH KATZER, member of the Commission on Mapping of Soils, Director of the National Geological Institute, died in Sarajevo on the evening of 3 February 1925 at the age of 64.

Dr. KATZER was born on 5 June 1861 in Rokycany (Bohemia). After passing through the intermediate school in Prague, he devoted himself to the study of natural science, especially geology and chemistry at the University and technical higher school of Prague. After his career as a student he acted as assistant teacher of mineralogy and geology in the Prague technical school, In 1887 he gave up this post so as to specialize in the study of geology in Breslau, Berlin, Tubingen, Marburg and Giessen. In Giessen he obtained the doctorate in philosophy in 1890. He then did some temporary work at the Prague Analytical Laboratory, and subsequently in 1892 at the Institute of Mines at Loeben. After three years of active work in Brazil, he returned to Europe and took service under the provincial government of Bosnia and Herzegovina in the capacity of State geologist, from that time devoting his

life and his work to those countries. The results of his scientific labours are embodied in more than 140 articles in scientific journals. Among the most important of these may be mentioned the following: *Geologische Karte Bosniens und d. Herzegowina; Geologischer Fuhrer durch Bosnien u. d. Herzegowina; Fahlerze u. Quecksolberlagerstätten Bosniens u. d. Herzegowina; Die Braunkohlenablagerungen Bosniens u. d. Herzegowina; Die Eisenlagerstätten Bosniens u. d. Herzegowina; Karst und Karsthydrographie.* KATZER did not live to see the accomplishment of his last monumental work "*Die Geologie Bosniens*" in 4 volumes, the publication of which has been begun by the Mining Section of the Bosnian Government, only the first volume having up to now appeared in German. F. KATZER received a number of decorations. He was also honorary member of several scientific societies and was elected in the year before his death member of the Belgrade Academy of Science. Quite recently the appreciation by the authorities of his scientific and official activities took the form of recognition by the conferring of the Royal Order of St. Sava. By his death a serious gap in the ranks of the scientific circles of Yugoslavia has been occasioned. But although removed by death, his work will endure and Yugoslavia together with Bosnia and Herzegovina will honour his memory.

A. SEIWERTH.

SPECIAL ACTIVITIES
OF THE BUREAU OF AGRICULTURAL SCIENCE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

INTERNATIONAL COMMISSION OF AGRICULTURAL METEOROLOGY.

INTERNATIONAL INSTITUTE OF AGRICULTURAL ECOLOGY (1).

An International Institute of Agricultural Ecology has been founded at Rome under the auspices of the Royal National Academy. At the inaugural meeting held on the 1st June, 1923 in the presence of H. M. the King of Italy, the President of the Academy spoke in praise of our initiative and expressed himself in the following terms:

" The Institute of Agricultural Ecology, which was founded under the auspices of our Academy with the object of co-ordinating and directing the work and researches on the growth and yield of crops all over the world, has continued its work, and to-day, thanks to the support it has received from all quarters, it has proceeded to the definite formation of an International Commission of Agricultural Ecology, also under the aegis of the Academy. This Commission will begin active work, as to the utility and importance of which it is unnecessary to insist " (*Atti Accademia*).

The Commission at present is formed of the following members, of whom the number will be gradually increased as the new research work develops and penetrates into the agricultural circles of the different countries.

(1) Report of the President of the International Permanent Commission on Agricultural Meteorology to the Permanent Committee of the International Institute of Agriculture and published by the order of the same.

INTERNATIONAL COMMISSION OF AGRICULTURAL ECOLOGY.

Argentina : Dr. C. BREBBIA, Delegate of Argentina at the International Institute of Agriculture.

Australia : Prof. GRIFFITH TAYLOR, Professor of Geography at the University of Sydney.

Belgium : Prof. F. SMEYERS, Professor at the Higher School of Agriculture at Ghent (Belgium) ; P. DE VUYST, General Director of Agriculture, Ministry of Agriculture, Brussels ; J. VAN DER VAEREN, Inspector General, Chief of the Cabinet of the Belgian Ministry of Agriculture and Public Works, Brussels.

Brazil : Hon. DEOCLECIO DE CAMPOS, Delegate of the United States of Brazil at the International Institute of Agriculture.

Bulgaria : Prof. H. E. MOLLOFF JANKO, Minister of Agriculture and Professor of Economics at the University of Sofia.

Canada : L. W. NEWMAN, Dominion Cerealist, Central Experimental Farm, Ottawa (Canada).

Czecho-Slovakia : V. NOVÁK, Chief of the Pedological Institute, Brno.

Denmark : Prof. E. LINHARD, Professor at the Higher School of Agriculture, Copenhagen.

Dutch Indies : C. OPOLSKI, Wanasoeka, Pengalengan (Java).

Egypt : C. B. WILLIAMS, Entomological Section, Ministry of Agriculture, Cairo.

France : G. WERY, Directeur de l'Institut National agronomique, Paris ; A. PRUDHOMME, Directeur de l'Institut National d'Agronomie coloniale, Nogent-sur-Marne ; A. CHEVALIER, Directeur du Laboratoire d'Agronomie coloniale, Paris.

Germany : Prof. Dr. P. HOLDEFLEISS, Professor of Agricultural Meteorology, University of Halle.

Great Britain : Sir JOHN RUSSELL, D. Sc., F. R. S., Director of the Rothamsted, Experimental Station, Harpenden ; B. A. KEEN, D. Sc., F. Inst. P., Assistant Director, Rothamsted ; C. A. BARBER, C. I. E., D. Sc., Professor of Tropical Agriculture, University of Cambridge ; W. S. GRAY, B. Sc., A. I. C., International Institute of Agriculture, Rome ; Prof. J. PERCIVAL M. A., F. L. S., Professor of Agricultural Botany, University College, Reading.

Great Lebanon : HAIDAR, Directeur de l'agriculture de l'Etat du Grand-Liban, Beyrouth (Syria).

Greece : T. ISAAKIDES, Director of Phytopathology, Ministry of Agriculture, Athens.

Holland : Dr. D. VAN GULIK, Higher School of Agriculture, Wageningen.

Indo-China : P. CARTON, Chef du Bureau des Renseignements agricoles à la Direction des Services Economiques de l'Indochine ; DU PASQUIER, Directeur de la Station expérimentale d'agriculture, à Phu-Tho, Tonkin ; The Governor General of Indo-China has appointed an officially Corresponding Commission, with the Directeur des Services Economiques as Chairman and composed of the following Members : (1). Le Directeur de l'Observatoire Central

Météorologique de l'Indochine ; (2) Le Chef du Service général de l'Agriculture ; (3) Le Chef du Bureau des Renseignements agricoles.

Italy : Prof. R. PIROTTA (*President*), Director of the Botanical Institute of the University of Rome ; President of the International Permanent Commission on Agricultural Meteorology at the International Institute of Agriculture (Rome) ; Prof. G. AZZI (*Secretary*), Prof. of Agricultural Ecology at the Higher School of Agriculture, Perugia and Director of the Department of Agricultural Meteorology ; Dr. A. BRIZI, Director General of Agriculture, Ministry of National Economy (Rome) ; Prof. L. PALAZZO, Director of the Central Bureau of Meteorology and Geodynamics (Rome) ; Conte EDOARDO SODERINI, Senator (Rome) ; Prof. O. MUNERATI, Director of the Experiment Station for Beet Cultivation (Rovigo).

Japan : Dr. H. ANDO, Director of the Imperial Agricultural Experiment Station, Nishigahara (Tokyo).

Kingdom of the Serbs, Croats and Slovens : MIRKO KORICH, Director of the Agricultural Experiment Station, Krizevchi (Croatia) ; V. V. GEORGIEVICH, Director of the Union of Rural Cooperative Societies of Pozarevac (Serbia).

Luxemburg : Dr. ZANEN, Ministry of Agriculture.

New Zealand : D. E. WARD, Instructor in Agriculture, Department of Agriculture (Christchurch).

Norway : Dr. ANDERS FJELSTAD, Delegate of Norway at the International Institute of Agriculture (Rome).

Portugal : Prof. FELIPE DE ALMEIDA FIGUEREIDO, Instituto Superior de agronomia, Cadeira de Fisica agricola, Lisboa (Lisbon).

Roumania : JONESCU SISESTI, Director General of Agriculture (Bucarest).

Russia : Prof. P. I. BROOUNOFF, Director of the Department of Agricultural Meteorology, Professor at the University of Leningrad ; Prof. VAVILOFF, Director of the National Institute of Genetics and Applied Botany (Leningrad) ; Prof. SCHEFLER, Collegiate Member, National Commissariat of Agriculture (Moscow).

Spain : THE COUNT OF MONTORNÉS, of the Royal Court of Spain.

Sweden : Prof. HJALMAR NILSSON, Director of the Experiment Station at Svalöf.

Switzerland : Dr. G. MARTINET, Chef de l'Etablissement Fédéral d'Essais et de contrôle de semences, at Lausanne.

Turkey : ALI RIZA, Director of the Higher School of Agriculture at Halkali (Costantinople).

United States of America : Prof. ASHER HOBSON, Delegate of the United States at the International Institute of Agriculture (Rome) ; Dr. J. G. LIPMAN, Director of the Agricultural Experiment Station, New Jersey ; F. CLEMENTS, Desert Laboratory Tuxon, Arizona.

The above have promised their active assistance and are not collaborators in name only, but will be of material assistance to the work of the Society. A large number have already contributed very interesting documents which will add to the success of our work.

A very good understanding may be established with the *International Institute of Agriculture* in the sense of the resolution adopted at the VII General Assembly. Further, the *Chair of Agricultural Ecology* founded at the *Higher Agronomic Institute of Perugia* by the Italian Government might well become a centre for the training of qualified technicians for the Ecological Stations of different countries.

The Executive Committee of the International Commission on Agricultural Ecology formed by the Members of the Commission present in Rome, at its meeting held on 12th February 1924, approved the following programme of work:

(1) The principles of Agricultural Ecology (Ecological unit);

(2) The Ecological Problem of Wheat;

(3) The International Network of Stations of Agricultural Ecology.

I.

THE PRINCIPLES OF AGRICULTURAL ECOLOGY.

Introduction. — It was and is still believed that it is possible to define the relations between the plant and its surroundings, by calculating the coefficient of correlation between the meteorological data and the statistical data of yield.

Leaving aside, in the present case, the question as to whether the well known formula of correlations is applicable or not, the result obtained affords a purely illusive solution of the problem. The importance, for instance, of the April rains in Apulia (Italy) as related to wheat yield, is quite evident; representing such by the term r (coefficient of correlation between April rains and grain yield) $= 0.7$, we are nowise nearer the solution of the problem of a better adaptation of wheat-growing to surroundings.

Meteorology applied to agriculture, in so far as it is based on the correlation method, has introduced mathematics into a field in which it cannot give the good results that were anticipated.

Agricultural Ecology, in which the surroundings as related to the growth and yield of crops are studied, brings the whole of these researches into the field of biology, and, cutting entirely adrift from meteorology and agrogeology, opens the way to a new branch of research.

Having chosen as our starting-point the term "yield", from which

we gradually arrive at the definition of the "ecologic unit", we will now, leaving aside the numerous questions of detail, deal with the idea and principles which fundamentally define and limit the field of agricultural ecology. These principles should be closely followed by all those who desire to contribute, on an international plan of collaboration, to the development of this science.

Yield.

The yield of a plant is the result of a relation between its productivity and resistence to the adverse phenomena of its surroundings.

In order to illustrate clearly this fact, the example is mentioned of the work done at Svalöf with the object of combining in the best possible proportions the high productivity of *Squarehead* with the resistence to low temperatures of the native wheat. For this purpose three principal hybrids were produced: *Pansar* (for the southern part of the wheat area in Sweden), *Sol* (for the central part) and *Thule* (for the northern part).

The following table gives the data of grain yield in quintals per ha. for the three stations, Svalöf (long. 56°C.), Linköping (long. 58°N.) and Ultuna (long. 60°N.). Assuming the yield of native wheat to be 100, the corresponding yield of these three varieties is given in brackets:

	Svalöf	Linköping	Ultuna
Native of Scania	27 (100)	—	—
» » Ostrogothland . .	—	27 (100)	—
» » Ultuna	—	—	28 (100)
Thule II	—	39 (144)	32 (112)
Sol II	41 (150)	42 (155)	26 (92)
Pansar III	45 (167)	39 (144)	26 (100)

At Svalöf "Pansar" produced 67 % more than the native wheat of Scania; at Linköping, where it does not resist the cold sufficiently and is too late, "Pansar" gave way before "Sol", which yielded 55 % more than the native wheat of Ostrogothland; and at Ultuna, "Thule" gives the highest return, but yields only 12 % more than the native wheat of the district. Still further north the severity of the climate requires the highest resistence on the part of the native wheat, the yield of which is then superior to that of the hybrids; it is scarcely possible any longer to increase productivity at the expense of resistence to low temperatures.

To avoid excessive complication, the "quality" of the yield has not been taken into consideration. The yield is often in inverse ratio to quality, and this fact should be borne in mind in order to succeed in combining those characters most desired by the grower.

Productivity (the intrinsic quality) and resistence to the various adverse phenomena are what we propose to call "economic characters": the more harmonious the combination of these characters, the greater the quantity (or the higher the quality) of the yield.

Ecologic Constants. — Two varieties, of equal productivity and in the same surroundings, may yield very different results according to their degree of resistence to certain adverse conditions.

Seeing that each variety reacts in a different way and to a different extent under the same influence of the same factor, the limits and optimum values of outside factors should be determined, not for "wheat", but for each individual variety of this plant, and of pure growth if possible. We will class these limits and optimum values as "ecologic", to distinguish them from the physiological limits and optimum values, which are determined according to a given function, without taking into account the effects which such function may have on the final result or yield.

For a given variety, then, the ecologic optima of temperature, moisture, etc., from a given point in the growth period, will be those temperatures or degrees of moisture which act on the plant in such a way as to develop to the full its yield capacity.

The difference between ecologic and physiologic values may sometimes be very great. For instance, the physiological thermic optimum of growth for the "Bon Fermier" variety of wheat, acting on the plant at the tillering period, causes a vigorous growth of tillers, but prevents earing by increasing the leaf growth. The difference between the physiological and ecologic optima is, in this case, certainly more than 12°C.

It is therefore indispensable to determine for each form separately, in what way and to what extent the yield varies in response to the variations of a certain factor, and the optimum value of the latter from the ecologic point of view.

The Critical Periods. — The requirements of the plant very in the different phases of its growth in such a way that the same quantity of rain, for instance, or the same temperature may, as regards yield, have very different results according to the times at which this quantity of rain or the temperature acts on the plant.

In this respect, the critical periods are of very special importance.

The critical period as regards a given factor is the comparatively short part of the growth period during which the sensitiveness of the plant attains its maximum to such a point that the fluctuations of this factor then have a decisive influence on the crop yield.

The ecologic optima and limits should therefore be determined especially during the respective critical periods.

The *twenty* days before earing are a very important critical period for wheat as regards soil moisture. The following table shows the yields of 3 varieties of wheat in quintals per ha. corresponding to various groups of precipitation values which influence the plant during the critical period:

Precipitation in mm.	Coccitta	Real Forte	Gentil Rosso
0-5	4	3	1
6-15	8	9	5
16-40	8	15	13
41-70	15	20	25

With the precipitation data at our disposal for a certain period of time, 10 years for instance, it can be found how many times in the said period the total precipitations in the critical period was 0-10, how many times 11-40, and so on.

By comparing the frequency of the different rainfall values with the corresponding yield values (see table), other conditions being equal, the total yield of each variety can be calculated during the period of 10 years, and thus can be established a criterion, in connection with the " Spring drought " phenomenon, for the choice of the most suitable variety.

Determination of Characters. — Three varieties of wheat which, during the period of 10 years, give the same total yield, proving very resistent to drought, may derive this capacity from three different forms of adaption:

(1) reduction of leaf surface;
(2) reduction in the number of stomata;
(3) deeper root penetration.

At the same time, drought is not a simple phenomenon, but the result of several factors, the number and proportions of which vary from one district to another, so that there may be different types of drought, each of which will require special forms of adaptation on the part of the plant. A variety showing resistence in one locality may

prove less resistent in another, and vice-versa. Again, by crossing two forms having the same degree of resistence, which however, is due to two different causes, the two characters may possibly be united in a single type and thus the degree of absolute resistence be increased.

In order therefore to form an exact opinion on a given variety, it is necessary to individualise those special morphologic and physiologic characters on which depend its behaviour under the adverse conditions of its surroundings.

These delicate and important researches, especially during the critical period when the relation between the plant and this particular factor is closer, should be continued throughout a series of experiments which allow the different factors to be isolated and their intensity increased up to the maximum limit, in order to accentuate the special characters it is desired to reveal, bringing them into relief and detaching them so to speak, from the body of the plant and its functions as a whole.

Ecological Unit. — When these characters have been determined, we can, by suitable crossings, find out, basing on the laws of segregation and recombinations of characters, the genetic factor or group of genetic factors which govern the said characters.

However, with the same genetic factor or group of factors, the character which is the physio-morphologic expression of this factor or group of factors, may present itself under another aspect if the surrounding conditions be changed. There are forms which are generally awnless, but which, sown in certain places under different conditions as to physical surroundings, may become awned.

Analogous phenomena take place as regards the "soft" and "hard" characters of grain, presence or absence of pigment, and tillering: that is to say, most of the characters on which the present botanical classification is based!

In these cases, consequently, the existing genetic factor or group of factors do not determine in an absolute and constant way the character in question, but, under certain environmental conditions, cause, for instance, the formation of awns, whereas, under other conditions, though with the same genotype, the formation of this organ does not take place.

It is therefore necessary to establish within what limits the awns are formed and the optimum surrounding conditions and limits. If, for instance, temperature were the most important external fac-

tor in the formation of the awns, by drawing a circle round a point representing the factor or group of factors in question and marking in this circle the temperatures compatible with the normal growth of the plant, the awned and awnless sectors could be found.

The plant should therefore be carefully studied under all possible different environmental conditions in order to compel the genetic factor to show all its possible reactions.

Only thus can one be sure of having individualised a character to the extent of being able to distinguish with certainty the genotype of the phenotype. After having completed this analysis, in the presence of a certain character it can deduced what genetic factor or group of factors are concerned, and the modifications such a character will undergo in different surroundings.

The total of all the physico-morphologic reactions of a genetic factor or group of factors constitutes what might be called an " ecologiccal unit " (" econe ").

These units are, in a certain sense, comparable to chemical atoms, and if, in order to analyse a long series of compounds, it is necessary to know the elements of which they are composed, then by analogy, in order to find out the fundamental lines of the " wheat " phenomenon in its numerous phases, the ecologic units of which it is composed must be individualised.

After what has been said above, it clearly becomes necessary to extend the field of research to rare varieties and those of little economic importance, dispersed in regions far from the great centres of cultivation, because, from the very fact of their isolation, they may have, hidden away, a wealth of unknown genetic factors, and give rise, when crossed with other varieties or transferred to other surroundings, to new and very interesting reactions.

Agricultural Ecology, by the complete analysis of the surroundings extended to the ecologic units, reveals not only the nature of the relations existing between the plant and its surroundings, but offers a basis for all the operations tending to modify these relations, with a view to utilising the surrounding resources by the best possible combination of characters.

THE ECOLOGICAL PROBLEM OF WHEAT.

In 1920 an enquiry was opened, details of which were widely distributed to Agricultural Institutions all over the world. The strik-

ingly large quantity and valuable nature of the data thus collected, will be utilised in a monograph which will enable us to establish what will be the task of each station in the solution of the ecological problem of wheat.

The arrangement of the data will result finally in a double classification :

(1) Classification of adverse phenomena, quite independently of absolute meteorological factors, but taking into account the negative influence they have on the plant.

(2) Classification of wheats, quite independently of the botanical characters on which the present botanical classification is based, but taking into account the behaviour of each type in the presence of adverse phenomena.

Classification of adverse phenomena. — The classification of adverse phenomena is, as has been said, based on the influence they exercise on the growth and yield of the plant.

The following are the precipitation and temperature limits (the figures being taken for each month) relating to the different sub-periods into which the growth period of wheat may be divided :

Limits		Sowing and harvesting	Tillering develop-ment	Earing and flowering	Formation and ripening of grain
Rainfall in cm.	maximum . .	200	80	—	60
	minimum . .	50	30	45	—
Temperature C°	maximum . .	—	+ 11	+ 28	+ 32
	minimum . .	—	— 5	+ 8	+ 8

The meteorological equivalent of the different adverse phenomena can thus be established preliminarily, though in a rather general way. When, for instance, spring drought in Italy is spoken of, it is understood that precipitations during the month preceding earing were generally below 45 mm.

Reciprocally, this equivalent being once established, the determination of the frequency of a phenomenon is greatly facilitated.

The following table, for instance, shows the rains for Foggia (Southern Italy) :

	1910	1911	1912	1913	1914	1915	1916
Sowing	132	65	69	160	28	121	115
Tillering	41	14	14	34	31	66	12
Earing	40	36	38	85	77	47	95
Formation and ripening of grain	45	102	49	55	69	107	25

For the period 1910-1916, then, there is drought *once* during sowing, *thrice* during tillering and *thrice* also in the spring (earing), and excess of rains *thrice* again during the sub-period between flowering and harvesting.

These remarks equally apply to the other phenomena.

A knowledge of the equivalents and the distribution of the meteorologic data over the different sub-periods, will then enable us to form at the outset an idea as to the climate of a given region as related to wheat cultivation (construction of the corresponding climoscope).

For each sub-period, the average monthly precipitations and temperatures are given, as well as the maxima and minima observed, etc.

The following is the climoscope for Temir (Asiatic Russia):

	1905	1906	1907	1908
Autumn period (sowing, harvesting, tillering)	4.5 mm. 31°.0 — 4°	19.3 mm. 36°.2 — 11°	16.6 mm. 28°.2 — 11°.8	17.4 mm. 33.4 — 10°
Winter period (rest)	10 mm. 17°.2 — 34°.3	20 mm. 22°.8 — 32°.9	12 mm. 20° — 38°.3	15 mm. 23° — 33°.4
Spring period (tillering, earing) . .	34 mm. 35° — 6°.6	17 mm. 37°.0 — 5°.5	15 mm. 36° — 0°.3	21 mm. 35° 0°.8
Summer period (flowering, formation and ripening of grain) . .	44 mm. 32° 7°	47 mm. 38° 7°	25 mm 39° 7°	15 mm. 37° 4°

Even a very rapid examination of this table will suffice to show the characteristic traits of the district: drought and cold for the greater part of the growth period (which render necessary irrigation and the choice of varieties which are resistent to low temperatures)

and an excessively high temperature during the formation of the grain (necessitating considerable earliness).

It is understood, that these meteorological equivalents are to be taken only in a general sense ; they must, indeed, vary in relation to the other physical phenomena and with the different varieties of wheat. But they afford neverthleess, a sound starting point and indicate the direction to be followed in analysing the surroundings, which analysis leads us gradually to the discovery of the ecologic units.

Classification of wheats. — This classification as stated, is quite independent of the characters on which the present botanical classification is based, being based on the behaviour of each variety in the presence of adverse phenomena.

A conventional scale of values is drawn up, from 1 (minimum of resistence, etc.) to 20 (maximum of resistence, etc).

Such classification will enable us at the first glance to gain an idea as to the characters, qualities and deficiencies of the different varieties, and will form a valuable guide (taking into account the frequency and intensity of the adverse phenomena) in the choice of the best variety, the determination of the optimum area of distribution and the improvements to be made by selection and crossing.

The following, for instance, is a table relating to some Italian wheats :

Name of variety	Physiographic district	Torrential rains	Rust	Low temperatures	Drought	Liming	Wind	Fog	Productivity	Quantity of product
Biancuccia	Sicily	—	—	—	20	—	—	—	18	18
Rossarda or Capinera .	Apulia	—	—	—	20	20	—	—	7	15
Trigu Canu	Sardinia	12	12	—	19	10	—	—	—	—
Biancone dell'Elba. . .	Isle of Elba	15	15	—	16	19	—	—	15	—
Fucense.	Central Italy.	15	15	13	—	—	—	15	—	—
Civitella	Northern » . . .	15	12	10	—	12	—	—	28	5
Gentil Rosso	N.-C. » . . .	12	12	10	10	10	—	—	19	19
Quattro Coste, Rossolona	Northern » . . .	15	12	13	—	—	—	—	—	—
Poulard Blanc	» » . . .	20	5	17	—	—	—	—	18	—
Hâtif Inversable . . .	» » . . .	20	3	14	5	5	—	—	18	12
Restajolo	» » . . .	13	13	15	—	—	15	—	—	—

The first column shows the district where the variety is grown : this knowledge is indispensable. A wheat considered as resisting low temperatures in a region with a warm climate may become very susceptible in one with a cold climate.

The Tystosfe Smaahvede variety, very resistent in Denmark, cannot succeed some degrees further north, in Sweden, where it is classed among the varieties which are very sensitive to heavy falls in temperature.

The classification of the adverse phenomena (knowledge of the meteorological equivalents) and the ecologic classification of varieties enable us, from the first year, to utilise the observation data. Suppose, for instance, two varieties of wheat are grown in the same district and possess, in respect of resistence to drought, the empiric degree 15. In a year of intense drought a single record made according to special instructions will indicate a certain superiority in one of these varieties. We can then add some points to the latter (from 15 to 17, for instance) and give it the preference in places where, from agrogeological, topographical, or other causes, the influence of drought is more felt.

The monograph however should lead to the compilation of two large tables: that of the meteorological equivalents of the adverse phenomena in every country (with the corresponding climoscopes) and the general table of the varieties of wheat with their ecologic points, drawn up exactly according to their behaviour in the presence of these phenomena, of which the meteorological equivalents are given.

These tables, which show us, so to speak, the strong and weak points of each climate and each variety respectively, will enable us to state logically the ecologic problem of wheat, which aims at reducing as far as possible the conflict between plant and surroundings, and at obtaining, consequently, an increase in yield by suppressing the weak points and coordinating the strong ones.

The monograph which will synthesize all that it has been possible to establish up to the prsent time, is the natural starting-point for our work.

This monograph will be followed by others, and the analysis will be gradually extended to other crops: investigations as to maize, sugar-cane, cotton and the olive, are already under consideration.

III.

THE INTERNATIONAL NETWORK OF STATIONS OF AGRICULTURAL ECOLOGY.

The executive organ of our scheme of work is the *International Network of Stations of Agricultural Ecology.* The network has already

been sketched out by the various Institutes of Agricultural Research and Instruction, which, being furnished with laboratories, test stations, instruments and technical experts and qualified staffs, are now in a position to collaborate with us.

For practical purposes, moreover, the influence of temperature and moisture, in a great number of cases, on variations in yield due to physical phènomena, may be put at 60 %.

Once the problem regarding temperature and moisture is solved it can be said that in a great measure the work is accomplished.

At first, consequently, it would be sufficient to take biological observations as well as readings of the temperature, precipitation and soil moisture. Afterwards, the progress of the work itself, in connection with surrounding conditions, will indicate what other factors must be studied and what other points are to be cleared up. As a matter of fact, what we ask of our collaborators comes within the scope of the work which every agricultural institution, independently of our initiative, should accomplish in order to gain that knowledge of the surroundings which is indispensable in all agricultural research.

To facilitate the progress of research, at first our collaborators may limit themselves to the charts of the self-recording instruments, omitting the direct readings made 3 times daily, which involve work that everybody is not always able to undertake.

Moreover, for the purposes of our work, the information afforded by the charts is more complete than that resulting from the observations by the meteorologists' method. Of what importance to the plant indeed is an average temperature based on the three readings made at 9, 13 and 21 o'clock, without taking into account either the night or the other times of the day ? The diagram of a thermograph, even of a mediocre instrument, is always superior, in that it gives us the temperature throughout and a very clear idea as to its distribution. But this is not all. Let us see what happens with the extremes of temperature. The thermometer at its lowest reading shows the degree to which the temperature fell, but gives no indication as to the duration of the depression. On the other hand it is clear that a fall to —5° for 2 hours may cause much more damage than a fall to —7° for a quarter of an hour only.

The same remarks apply to maximum temperatures. In any case, therefore, the charts are preferable to direct observation at fixed times. Direct readings taken at any time may however be

utilised to correct the diagram, by marking on the diagram the most striking readings taken during the week and registered in the notes. Afterwards, and as a consequence of the results obtained, it will perhaps be necessary to establish for each species a system of direct readings, the hour, date and frequence of which however will still be subordinated to the ecologic point of view.

We shall also have to subordinate the installation of the instruments to the ecologic point of view. The different depths at which the geo-thermometers are placed should be chosen with due regard to the thickness of the root mass, the arrangement of the soil layers, etc. It is not a question of controlling FOURIER's formula, indeed, but of knowing the temperatures which influence the root. As regards the method of observation also, we are obliged then to go farther and farther from the field of physics and enter once more fully into that of biology.

In the Stations of Agricultural Ecology, a series of observations are being made on the growth of plants and the conditions of the physical surroundings.

The programme of work at the Central Bureau with its network of Stations may comprise the four following phases :

(1) *Agronomy* : Determination of the yield of the varieties grown in a district under various conditions of soil and climate, never losing sight of the fact that yield is the result of a relation between productivity and resistence to adverse conditions.

(2) *Plant morphology and physiology* : Determination of the physio-morphological characteristics as connected with the expression of economic characters ; choice of pure lines in the ecologic sense.

(3) *Genetics* : Individualisation of the genetic factors which determine the above-mentioned characteristics ; crossing of varieties in the ecologic sense.

(4) *Ecology* : Determination of the ecological units and production of the best combinations with the object of obtaining the maximum yield.

Thus, starting with empiric knowledge (1), scientific knowledge (4) relative to the yield is obtained.

The plan of work, as we have conceived it, renders the collaboration of the Agricultural Institutions simple and easy, without it being necessary to have recourse to heavy expense for installation, and without necessitating at the same time excessive work on the part of the collaborators :

(1) Every observation, even if isolated and taken for one occasion only, will always be utilised within the plan in which the data are so to speak automatically classed and assigned a certain place. Nothing is wasted.

(2) All the stations installed in accordance with the instructions of the Central Bureau will be of the same value from the technical point of view. As regards the organisation of the Ecological Department, the differences between various countries in their advance in the domain of agricultural experimentation, therefore, only affect the density of the network. The Ecological Stations of the network are equal, both in the most advanced countries and in the most distant and isolated localities.

The network is therefore a single organism, established on a solid basis, and having a single dynamic centre.

(3) Uniform organisation, absolute unity of method and administration, lead to the true internationalisation of a service. The distribution of work, the scientific and methodical application and exchange of results, and, later perhaps, the transfer of observers from one country to another will open the way to collaboration, the importance of which it seems unnecessary to dwell upon.

G. Azzi,
Secretary.

R. Pirotta,
President.

ENQUIRY ON DAIRY COW TESTING.

THE DEVELOPMENT OF THE DAIRY INDUSTRY IN INDIA. (1)

The development of the agricultural interests of India by State owned scientific departments only dates back about 20 years, and in the early days the first agricultural officers naturally devoted the major part of their energies to the improvement of the staple food crops of the people, with the result that the scientific development

(1) Report sent to the International Institute of Agriculture by M. S. A. Hydari, Acting Under Secretary to the Government of India, Department of Education, Health and Lands, in response to a questionnaire on the "Testing of Dairy Cows".

of the cattle breeding dairying industry did not receive much attention until within recent years.

Much valuable pioneer work in the development of dairying in India has been done by the Military Department of the Government of India. The medical authorities responsible for the health of British troops stationed all over India became alive many years ago to the fact that the health of the soldier and his family depended largely on a pure and safe milk supply, and that the spread of epidemic diseases could not be prevented unless the supply of dairy produce was under such control as to render it safe. To provide this safeguard and to ensure that the soldier in India was supplied clean and pure milk and butter, the military authorities established their own dairy farms at all the large cantonments in the country. Between 1900 and 1910 some thirty military dairy farms were founded, and from the commencement these farms have been run on sound scientific principles, and have demonstrated to the community at large the possibility of commercial dairying on modern lines.

The combined milking herds of military dairy farms in India must at the present moment be not far short of 10,000 animals, and careful records have been kept of the yields of each individual animal which at any time belonged to the milking herds of these farms. By careful selection and breeding, pedigree pure bred herds of indigenous cattle of "Sahiwal", "Sindi" and "Hariana" cows and of "Murra" buffaloes have been built up, and much careful work done in crossing the milking breeds of Indian cattle with imported Ayrshire, Holstein, and Shorthorn bulls. Surplus bulls from the pure bred Indian herds at military dairy farms are sold to the general public and have done much to improve private owned herds in many parts of the country.

Military dairy farms in India have done pioneer work in connection with the growing of special fodder crops for dairy cattle, and the Government military dairies are equipped with modern milk pasteurising and cooling plant, mechanical refrigeration and cold storage.

In addition to dairy farms proper for the production of fresh milk from their own cattle, the military authorities have been the pioneers of modern factory dairying in this country. In 1910 the Government Central Butter Factory in Gujerat was opened by the Military Department. This creamery is equipped with the latest and most modern plant and during the war in addition to the supply of butter for troops in India and overseas, manufactured

large quantities of Cheddar cheese for the use of the Army in Mesopotamia.

The Imperial Department of Agriculture in India, as apart from the military dairy farms, first took up the question of the development of the dairy industry in 1906, when the then Director-General of Agriculture in India founded the existing herd of pure Sahiwal dairy cattle at Pusa. This herd was divided into two parts, one being developed as a herd of pure Indian cattle and the other crossed with European blood. The herd has since been greatly increased and by selection and breeding on milk producing lines, the average yield of the pure Sahiwal portion has been practically doubled since its inception. Crossing experiments with pure European breeds are still being carried on, the aim of this work being to discover whether the introduction of foreign blood is a practical proposal from the point of view of the development of the village cattle in India. Authentic records of yields of all individual animals have been kept at Pusa since the beginning and much valuable data concerning the chemical composition of the milk of Indian cattle, cross-breeding, etc., have been obtained and communicated to the Indian agriculturist through the medium of the Indian Agricultural Journal, bulletins and articles in the press.

A Central Cattle Bureau under the control of the Imperial Agriculturist to the Government of India, is about to be established at Pusa, and it is intended that this office should undertake the work of keeping and certifying pedigree records of Indian breeds of cattle, of promoting and controlling milk records of non-Government-owned herds and similar work.

In addition to the development of the dairy herd at Pusa the Government of India in 1919 established a special department at Pusa for the study of the very important question of animal nutrition. This department, which is now located at the Imperial Institute of Animal Husbandry and Dairying at Bangalore, South India, is under control of an eminent chemist designated the Government Physiological Chemist assisted by a highly trained staff, and the equipment of the laboratories, special cattle sheds, etc., devoted to this work are equal to that of any similar institution in any part of the world. The results of research work done by the Government Physiological Chemist and his staff are made available to the public in the usual way.

In 1920 the Government of India sanctioned the appointment

of a special expert officer known as the Imperial Dairy Expert to assist in the development of the Dairy-Cattle breeding industry, and in 1923 the Imperial Institute of Animal Husbandry and Dairying at Bangalore, South India, and the Imperial Cattle Farm at Karnal in Northern India were founded and placed under the charge of the Imperial Dairy Expert. The former Institution which is equipped as a modern Dairy College and Research Institute, in addition to accomodating the laboratories and offices of the Government Physiological Chemist before referred to, has a herd of about 200 cross-breed Indo-European milk cattle, a small herd of pure bred Sindi cows and a number of Murra milch buffaloes. This Institute is equipped with modern milk separating, pasteuring and bottling plant, mechanical refrigerating machinery, cold storage, modern butter making machinery, ghee-boiling plant, cheese-making plant, mechanical milking machine, electrically operated pumping machinery, food preparing plant, etc., and takes pupils for a special two years course for the Indian Government diploma in dairy farm management, as well as post-graduate pupils from the Indian Agricultural Colleges, and short course students actually employed in the dairy industry in the country.

The Imperial Cattle Farm at Karnal in the Punjab comprises an area of about 2000 acres of which 1600 acres are irrigated from the Western Jumna canal, and set apart for experimental cattle breeding. Up to the time of writing, herds of three indigenous breeds have been established at Karnal, viz : Thar-Parker, Hariana and Sahiwal, the aim being to demonstrate the usefulness and economic value of the dual purpose cow for India, *i. e.* a type of animal possessing milk producing qualities in the female and draught qualities in the male. A modern milk sterilising plant on the Mentor-Danish system has been installed at this farm to demonstrate the possibilities of milk sterilising and transport and the farm is used as a teaching centre.

The foregoing briefly indicates the activities of the Imperial Government in connection with the development of the Dairy Cattle Breeding Industry ; but in addition to this, much useful work has been done and is being done by the Agricultural and Veterinary Departments of Provincial Governments in India. These may be briefly recounted as follows :

Punjab. — Government owned cattle breeding farms have been established and grants of land for the development of cattle breeding

given to private individuals. The Hissar cattle farm of this province having an area of about 40,000 acres, is the largest of its kind in the East. Stud from this farm are distributed all over the province, and the Veterinary Department which is responsible for cattle breeding work in the Punjab is developing this breed along dual purpose lines, milk production being given a prominent place, among qualities necessary for selection of stud bulls in the herd.

The Punjab Government Agricultural College at Lyallpur has a pedigree herd of Sahiwal dairy cattle and the College dairy is equipped with modern milk pasteurising plant, refrigerating machinery, etc. Dairy instruction is given to all agricultural students.

United Provinces. — This Government employs a special whole-time expert officer for cattle breeding and dairying who is a member of the Agricultural Service. Government cattle breeding farms have been established and stud bulls are issued to villages from these institutions. The aim of the Agricultural Department of this province is to develop indigenous breeds of cattle along dual purpose lines, *i. e.* milk and draught.

The Agricultural College at Cawnpore has a dairy with a pedigree herd of first class Sindi cows and teaches the elements of dairy farming to all agricultural students.

Bihar and Orissa. — A Government Cattle Farm is maintained at Sabour under the control of the Agricultural Department, and the work carried on there has the object in view of improving local breeds on dual purposes lines, and stud bulls from the Goverment. Farm are issued to local breeders.

Bengal. — The Government of Bengal has a pedigree herd of Sindi cows at the Agricultural Institute at Dacca and a large cattle breeding farm at Rungpur. At the latter farm much good work has been done by crossing the local small sized cattle with Thar-Parker and pedigree Hariana bulls, the latter obtained from the military farms department. Stud bulls are issued to village communities and private breeders from Rungpur Farm.

Central Provinces. — A special whole time expert officer employed by the Agricultural Department of this province for cattle breeding and dairying. About ten Government owned cattle breeding farms have been established throughout the province. Stud bulls are reared at these farms, purchased from military dairy farms and the Agricultural Departments of other Governments, for sale and issue to breeders. The aim of the Department is to improve indigenous

breeds along dual purpose lines by crossing with outside Indian breeds of known merit, selection etc.

The development of co-operative dairying has had some degree of success in this province, the Telinkeri Co-operative Dairy Society for the production and supply of fresh milk to Nagpur city being the largest and most successful concern of this nature in India. This Society was promoted and fostered by the Agricultural Department of the local Government.

The Government Agricultural College at Nagpur has a herd of Ayrshire-Indian cross breed dairy cattle and a dairy fitted with pasteurising plant, mechanical refrigerating, etc. Dairy instruction is given to all agricultural pupils.

Bombay. — Of late years the Agricultural Department of this province has done much to develop the dairy cattle breeding industry within its borders. A whole time expert officer of the Agricultural Department is employed for dairy-cattle breeding. Government cattle farms exist at five different centres and pedigree herds of Amrit-Nahal, Kankrei, Khilari, and Sindhi breeds of cattle are maintained and stud bulls of all these breeds issued to village communities, private breeders, etc.

The Government of Bombay two years ago appointed a special commission to enquire into the whole question of cattle breeding and dairying and to make recommendations, and in pursuance of the recommendations of this body this Government is at the present moment taking steps to establish additional cattle farms, provide reserve supplies of fodder against famine years, etc.

The Government Agricultural College at Poona has two herds of pure bred Sindi cows and Surti milk buffaloes, and a small dairy. Elementary dairy instruction is given to all agricultural students and plans have been prepared by the Imperial Dairy Expert for the building and equipment of a modern college at Poona, which it is hoped will be established next year.

Madras. — A whole-time expert officer of the Agricultural Department is employed for cattle breeding and dairy work. Government cattle farms exist at three different centres in the province. Pedigree herds of Ongole and Kangyam cows and of the local milch buffalo are maintained and stud bulls are issued to the public from these farms. A dairy herd of Ayrshire-Indian cross bred cows is kept at the Government Agricultural College, Coimbatore, and the college dairy is equipped with modern milk pasteurising and re-

frigerating plant. Dairy instruction is given to all Agricultural students.

Burma. — A small dairy herd of pedigree Sindi cows is maintained at the Agricultural College, Mandalay, for the instruction of agricultural students.

The Agricultural Departments of some of the Indian States have of late taken a considerable interest in the development of the dairy-cattle breeding industry. The Government of Mysore employs a full time expert officer of the Agricultural Department for dairy-cattle breeding work. The Government of His Highness the Gaekwar of Baroda maintain a pure bred herd of Gir cows and Jaffarbadi buffaloes and issue stud bulls of these breeds to village organisations, and herds of local breeds have been founded by the Governments of Hyderabad, Gwalior, Dhar and Patiala.

That the Municipal Corporations of the larger Indian cities are alive to the importance of more perfect supplies of fresh milk is evident from the fact that the Corporation of the City of Bombay employ a special dairy expert with the highest scientific qualifications, in their health department, and both this corporation and the Municipal Corporation of the City of Rangoon have on foot extensive and well considered schemes for the closer control of the existing milk industry of their cities and the provision of better, cleaner, and cheaper supplies in the future.

The dairy cattle breeding industry in India is in a backward condition and will probably continue so far many years, but the foregoing will show that those responsible for the agricultural progress of the country recognise the importance of the development of this great industry and, consistent with the means at their disposal, are doing everything possible to further the cause of dairy progress on sound lines.

W. SMITH,
Imperial Dairy Expert (India).

ENQUIRY ON LOCUST CONTROL.

Locusts in Cirenaica.

Report from the Government of Cirenaica, transmitted to the International Institute of Agriculture by the Italian Colonial Ministry.

In Cirenaica up to the present there have been no other important invasions of locusts except that recorded in May 1918.

Almost every spring however the presence of locusts is observed in

Bengasin and on the table-land, but they scarcely ever do serious damage to the crops.

On the supposition that these Orthoptera might later on cause damage to the crops, the Government of Cirenaica have directed the Department of Agriculture to collect promptly all the data necessary for organising measures of control against locusts, and to transmit these data to the International Institute of Agriculture.

Locusts in Tripoli.

Comunication from the Government of Tripoli transmitted to the International Institute of Agriculture by the Italian Colonial Ministry.

In Tripoli, from the date of the Italian occupation, there have fortunately never been any flights of locusts, except on one occasion towards the end of 1914, of slight importance and finishing in the sea. This occurred in the Gebel coastal zone and that of Ghibla, West and East, under our dominion. It has not been possible up to the present to get direct information as to invasions which may have taken place in the districts farther in the interior (Fezzan, Gat, etc.), though the probability of such may be almost excluded, since from the caravans and the natives coming from those parts news of flights would have been received, seeing the disastrous effects of these invasions on the agriculture of the Sahara oases.

ENQUIRY ON THE PREVENTION OF ANTHRAX INFECTION OF HERDS.

Report.

In carrying out the decision of the General Assembly of the International Institute of Agriculture, May 1924, the questionnaire relating to this enquiry was sent to all the adherent States of the Institute as well as to 44 other Countries and Colonies.

At the request of the International Labour Bureau important information has been collected and is now being elaborated for inclusion in a report which will be sent, in October 1925, to the next meeting of the Agricultural Advisory Committee, which is composed of three members of the Administrative Council of the International Labour Bureau and three members of the Permanent Committee of the International Institute of Agriculture.

ENQUIRY ON THE STOCK BREEDING SERVICES AND HIGHER INSTRUCTION IN STOCK BREEDING.

The first results.

The questionnaire relating to this enquiry has been sent to the 71 adherent States of the Institute as well as to 44 other countries and Colonies.

The Institute has, up to the present, received about 55 replies, accompanied by numerous schedules. The information collected will be elaborated for inclusion in a monograph on the question, to be compiled in collaboration with Prof. B. MAYMONE of the Italian Council of the Association of Travelling Chairs of Agriculture.

ENQUIRY AS TO THE RESULTS OBTAINED BY FARM ACCOUTANCY.

New Enquiry.

The Bureau of Agricultural Science of the International Institute of Agriculture has organized an enquiry on the results obtained by means of agricultural book-keeping according to the method proposed by Prof. LAUR (Organization of international statistics based on the results of investigations carried out with the assistance of agricultural book-keeping. *Int. Rev. of Science and Practice of Agric.*, N. S., Vol. II, No. 3, 1924).

A preliminary exchange of views has taken place with Prof. LAUR himself, Prof. TAYLOR, Chief of the Bureau of Agricultural Economics, U. S. Dpt. of Agriculture, Washington, and Prof. P. BORGEDAL, Chief of the Agricultural Book-Keeping Bureau of « Det Kgl. Selskap for Norges Vel », Oslo.

The subject will be discussed also by the Committee on Agricultural Economics of the Ministry of Agriculture and Fisheries, London.

AGRICULTURAL INTELLIGENCE

AGRONOMY.

Soil Science.

See R. Part II, *Proceedings of the International Society of Soil Science*, Abstracts.

Fertilisers and manures.

556. Fertiliser Tests with and without Ground Limestone.

BLAIR, W. S. (Superintendent, Dominion Experiment Station, Kentville, N. S.). *Scientific Agriculture*, Vol. No. 6, pp. 199-201. Ottawa, 1925.

The test was started in 1914 to ascertain the most profitable source of nitrogen and phosphorus; on a similar series of plots ground limestone was applied to gain information as to its value when used in conjunction with such fertilisers. A three-year rotation of potatoes, grain, clover and timothy hay was followed.

Potatoes are not a good crop for experiments in which lime is continuously applied, owing to the fact that it favours scab, which in this case reduced the market value of the crop. In every instance there was a marked increase in yield of the limed over the unlimed plots.

Nitrate of soda gave slightly better results than sulphate of ammonia. On the unlimed, sulphate of ammonia plots, acidity increased. Basic slag gave slightly better returns than acid phosphate. Limestone was of greatest benefit to clover and to the hay crop. Wheat responded in a marked degree to lime. Limestone should not be applied to a potato crop. To apply when sowing with grain is advisable.

Limestone more than doubled in quantity the hay crop and gave hay of better quality. Its use enables clover to be grown on soils which otherwise would not grow this crop. W. S. G.

557. **Nitrifying Bed for Prevention of Nitrogen Losses from Cattle Urine.**

JOSHI N. V. (First Assistant to the Imperial Agricultural Bacteriologist). *Agricultural Journal of India,* Vol. XX, part. I, pp. 20-36. Calcutta, 1925.

Large losses of nitrogen occur when cattle urine is kept under aerobic conditions. The author carried out experiments to ascertain whether this loss could not be prevented by employing some form of nitrifying bed in which bacteria would convert the nitrogen into nitrates. Two methods were found: in the first, the urine is passed over a nitrifying bed and a solution of nitrates is obtained; in the second method the urine is absorbed by means of a specially prepared or activated soil.

In the first method, pumice or broken bricks form the bed; the urine is diluted with ten times the quantity of water and nitrification takes from 8 to 10 days, under the conditions of the experiment.

Even with crude methods of handling, allowing a loss of 40 to 50 % of nitrogen, it is estimated that 1 to 1.25 maunds (1 maund = 82 lb.) of potassium nitrate per annum could be recovered from the urine of one animal, if converted into potassium nitrate by this process of intensive nitrification.

W. S. G.

558. **Manurial Value of Sugar Cane By-Products.**

DYMOND, G. C. *Sugar,* Vol. XXVII, No. 3, pp. 134-135. New York, 1925.

Sugar cane requires about nine primary chemical substances as plant food material, and the deficiency of any one of these, and not the superabundance of the others, determines the crop yield, hence the importance of returning to the soil, residues containing chemical bodies removed by the crop.

Samples of cane trash and tops were taken from a 15 months old plant cane; the stalks showed an average sucrose content of 12.4 %.

Analyses of the dry substances were made, the ash giving the following results:

Tricalcic phosphate: in trash, a trace; in tops, 6 % or 17 lb. per acre.

Potash: in trash, 3.2 % or 15 lb. per acre; in tops 23 % or 77 lb.

Magnesium oxide: in trash 1.8 % and 6.17 % in tops.

Chlorine: 0.5 % in trash and 9.4 % in tops.

The value of the dry trash is about 4s. 3d. per ton, or 12s. per acre, and that of the dry tops 19s.9d. per ton, or 38s. per acre.

On a crop of 100 000 tons of cane the value of the dry tops would be £6170 and that of the trash £1550.

Analyses of the bagasse ash showed: silica 66.5 % :tricalcic phosphate 3.2 %; potash 4.4 %; sulphates 12.63 %; the total value of the potash and phosphate being 19s. 7d. per ton.

Dry filter press cake contained: nitrogen 1.06 %; phosphate 3.13 %; potash nil; the value works out at 18s. 7d. per ton. This cake is very suitable for light soils when applied at the rate of 6 to 8 tons per acre.

The manurial value of molasses works out at 9s.10d. per ton, or £1536 per 100 000 tons of cane, of which £1276 is due to the potash content. The most scientific method of dealing with this product is first to obtain the sugar value in alcohol, and than to utilise the residue as manure.

Sugar cane should not be an exhaustive crop if, as is possible in practice, a large proportion of the chemical substances removed by the crop are returned to the soil. W. S. G.

559. **Basic Slags and Mineral Phosphates.**

VANSTONE Dr. E. *Journal of Agricultural Science*, Vol. XV, Part 1, pp. 36-46, figs. 2, bibliography. London, 1925.

With reference to the evaluation of basic slags, there is still much difference of opinion as to the value of the citric solubility test.

In order further to study the question the author investigated the relationship between phosphate soluble in 2 % citric acid and total phosphate of known composition, basic slags and mineral phosphates.

In the case of ferrous and ferric phosphates, aluminium phosphate, dicalcium phosphate and apatite it was found that, after 30 minutes shaking in 2 % citric acid solution: apatite was totally insoluble, ferric phosphate almost insoluble, ferrous phosphate and dicalcium phosphate almost completely soluble. The results obtained are shown in Fig. 116, from which it will be seen that the graphs are straight lines (except aluminium phosphate), and that they pass through the point of origin.

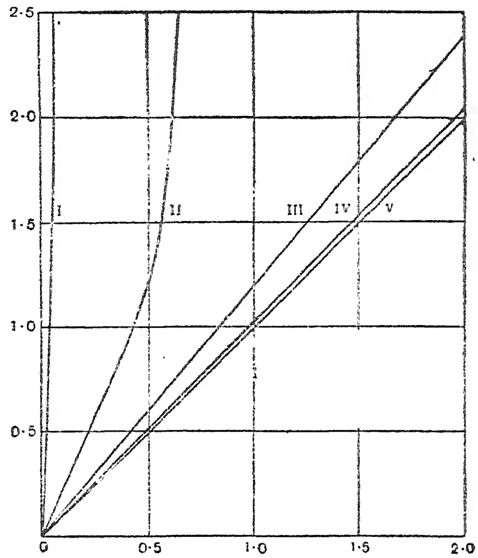


FIG. 116. — Solubility curves of phosphoric acid in various phosphates:
I. Ferric phosphate and apatite.
II. Aluminium phosphate.
III. Mixtures of calcium carbonate and tricalcium phosphate
IV. Ferrous phosphate
V. Dicalcium phosphate.
Ordinate = gms. of $P_2 O_5$ present.
Abcsissa = gms. of $P_2 O_5$ soluble in citric acid.

In the case of each of the three basic slags of widely differing solubility, the graph is a straight line showing that citric solubility is a constant, independent of the weight taken in the test. The ratio of soluble phosphate to total phosphate in the case of the mineral phosphates Gafsa, Ephos,

Nauru and the West Indian phosphate, Buccaneer, depends on the weight taken in the test, and the graphs are curves (fig. 117). The author carried out experiments with beans in order to ascertain if there is any relationship between citric solubility and plant growth, and obtained conclusive evidence that the intake of phosphoric acid from basic slags is directly proportional to citric solubility. W. S. G.

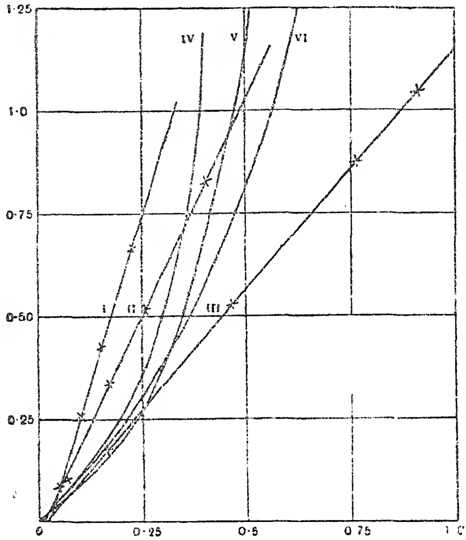


FIG. 117. — Solubility curves of phosphoric acid in various phosphates.
Ordinate = gms. of P_2O_5 present.
Abeissa = gms. sf P_2 O_5 soluble ln cidric acid.
I. = Low grade Basic Slag 18 %
II. = » » » » 21 %
III. = High » » 37 %
IV. = Nauru phosphate
V. = Gafsa.
VI. = Bucaneer.

560. Recovery of Potash from Steffan Waste Water.

GELDARD, W. J. and CHASE. W. D. *The Planter and Sugar, Mahufacturer*, Vol. LXXIV, No. 11, pp. 208-210 tables 7. New Orleans, 1925.

In the manufacture of beet sugar, molasses is produced in much the same manner as in the case of cane sugar. In the process of fractional crystallization, molasses, a residual liquor, is produced which still contains about 50 % of sugar and this is recovered by the Steffan lime, or similar process; a waste product results known as Steffan waste water, containing about 3 % solids, which consist of nitrogenous and other bodies.

Statistics show that that annual production of Steffan waste water in the United States is about 2,500,000 tons.

If the evaporation of the waste water is controlled so that a definite specific gravity is obtained, potash salts will separate out practically free from salts of sodium or other metals. The author's experiments indicate a possible yield of 227 lb. of crude salts, or 199 lbs. of recrystallized salts per ton of concentrated water. The original waste water with a dry substance content of 2 to 4 % must be evaporated until the content is about 68 %. The production of potash salts during evaporation should form only a part of a complete system of recovery of waste products. W. S. G.

561. World's Situation as regards the Nitrogen Problem.

Nitrogen Survey, part. I, FOSTER BAIN, H. and MULLIKEN, H. S. The Cost of Chilean Nitrate. *United States Department of Commerce, Trade Information Bulletin*, No. 170, p. 69. Washington, 1924.

Part II. CURTIS H. A. General Review of the Nitrogen Situation in the United States. *Bull.* No. 226, p. 63, figs. 6. *Ibidem.*

Part III. BRAHAM J. M. The Air-Nitrogen Processes. *Bull.* No. 240, p. 41. *Ibidem.*

Part IV. CURTIS H. A. and ERNST F. A. The Nitrogen Situation in European Countries. *Bull.* No. 270, p. 49. *Ibidem.*

The greater part of the fixed nitrogen used at present throughout the world is from Chilean nitrate, which is a trade monopoly. The necessity of rendering the various countries independent in this respect is evident, for, seeing that nitrate is largely used in agriculture and as a raw material in many industries, and also that it is used in the manufacture of explosives for military purposes, it may be of considerable importance in national security. The present article is a summary of an investigation which has been made with the object of ascertaining whether it is possible, in this respect, to ensure America's independence of the Chilean monopoly.

The world's situation, then, as regards the nitrogen problem, is examined, the state of the trade in Chilean nitrate and of the nitrogen industry in the United States being first studied. The enquiry then passes to a review of the different processes by which nitrogen may be obtained from the air, and to the state of the problem in European countries.

Chilean nitrate. — For the present it need not be feared that the supply of raw material in Chile will be exhausted; it will probably supply nitrogen for one or more centuries. Nor is it improbable that later on a reduction in the price of nitrogen itself will be realised; this will mostly depend on competition with other means for producing nitrogen. Such reduction however cannot be based on the lower cost of extraction from raw material; it is probable indeed that there will be a rise in prices under this head owing to the increased demands of the workers. On the other hand improvements in the processes employed may take place through the use of more suitable methods, a 25 % increase in yield being thus obtained, while the opening of large central establishments will lead to a saving of 25 % in the cost of production. In these conditions also lower grade materials may be used, thus increasing production. On the other hand it will be difficult to obtain reductions in the cost of transport and further treatment in the producing country.

Export duty forms one of the chief items of secondary expenditure: at the present rate of exchange for the pound sterling (4.90) it amounts to 10.46 dollars per short ton (q. 9.0718). The importance of this item of the cost of nitrogen depends on Chile itself, which, in view of competition, may reduce her tariff. An increase, however, of 1-2 dollars per ton may take place in the cost of sea transport, which is now somewhat low. It should also be considered that at present the rate of exchange for the *peso* is favourable to America to the extent of 5.93 dollars per ton, but with the adjustment of the rate of exchange, this advantage will gradually cease.

Speaking generally therefore, so long as no substantial reduction in export dues takes place, it may be concluded that the increase for sea freight and the variations in the exchange may counterbalance reductions in the cost of production and also lead to a slight increase of the final price in American ports. This may be put at 30 dollars per ton payable within a short period and 35 dollars for a longer period.

Exportation of Chilean nitrate.

Countries exported to	Tons exported	% received
Europe and Egypt	896 411	71.6
United States	279 169	22.3
Other countries	76 470	6.1
Total	1 252 050	100.00

Situation in the United States. — Home production is from: (1) Ammonium nitrate obtained as a by-product from industries using coal; of this ⅓ is exported and the rest is used in other industries and, especially, in agriculture; (2) Organic ammonia obtained from cotton-seed meal, etc: a small part is exported amd the rest is used for the production of mixed fertilisers; (3) Atmospheric nitrogen, produced in small quantities only.

The United States chiefly import Chilean nitrate; then comes 50 000 tons of Canadian cyanamide and a few thousand tons of Norwegian nitrate and organic ammonia (dried blood, guano).

The requirements of agriculture and industry in the matter of nitrogenous products are various, for the former chiefly needs nitrogen and the second one or another of the salts. In agriculture it may be a matter of indifference whether Chilean nitrate or atmospheric nitrogen be used, but this is not the case in industries. But there are also various requirements as regards the nitrogen used in agriculture; thus ammoniacal nitrogen, produced at a very low cost, is not directly utilisable and must be combined with sulphuric or phosphoric acid for which purpose other plant is necessary. Following on industrial progress, a gradual reduction in the price of nitrogen may be obtained, but it will be long before such reduction can be felt in agriculture.

Production and Consumption of nitrogen in the United States (1922).

	short tons
Nitrogen distilled from coal	98 000
" " " bones	200
Atmospheric nitrogen	3 000
Nitrogen imported (exclusive of blood, guano, etc.)	116 861
Total	219 061
Exported	39 389
Consumption	179 671

Putting the consumption in round figures at 180 000 tons, this is equivalent to 900 000 tons of ammonium sulphate and 1 154 000 of Chilean nitrate. For 1925 the figures are about 260 000 tons:

Production of atmospheric nitrogen. In less than 20 years this process has developed from a simple laboratory research to an industry which can produce yearly more than 550 000 tons of fixed nitrogen. This quantity, converted into sodium nitrate, would yield 2 565 000 tons, *i. e.* a larger quantity of nitrate than is exported annually from Chile; converted into ammonium sulphate it would yield 1 940 000 tons, equivalent to that obtained from 155 000 000 tons of coal. This industry has certainly not yet reached its full development; the essential thing is that nitrogen may be obtained at a lower price than that realised for the increase of agricultural produce obtained by its use.

The processes for the fixation of atmospheric nitrogen are chiefly the voltaic arc, cyanamide and synthetic ammonia; the cyanamide process is now followed in small establishments. The synthetic ammonia process seems to promise best, but the industry for the fixation of atmospheric nitrogen is still in its infancy and its future development cannot yet be foreseen.

The war has given a great impulse to this industry.

In 1923 the production of atmospheric nitrogen was 496 000 tons, viz. 36 000 by the arc process, 140 000 by the cyanamide and 320 000 by the synthetic ammonia. process.

The nitrogen situation in European countries. Besides Chile there are few countries in the world which export nitrogen. Among these is Norway, which has greatly developed the atmospheric nitrogen industry and has slight need of it in agriculture; Great Britain also exports more nitrogen than it imports owing to the fact that agriculture makes small demands on its supply, and the coal-industry production is large. Before the war Germany was one of the largest consumers of Chilean nitrate instead of which it can now supply its own needs, and not improbably will become an exporter. The majority of the most densely populated countries import nitrogen and it may be predicted that even if the nitrogen-producing industries develop in them, local production will always be insufficient.

Of the following data (expressed in tons of fixed nitrogen) some have been taken by the authors from those supplied by the International Institute of Agriculture.

Germany: (fiscal year 1922-23).

Production of fixed nitrogen	Tons
From coal	75 000
Cyanamide	35 000
Synthetic ammonia	210 000
Total	320 000
Consumption in 1922	295 000

France : Imported 68 453 ; Exported 8 400 ; Consumed 69 000.

United Kingdom : Nitrogen produced in the coal, iron, etc. industries (1921) 54 333 (256 895 of ammonium sulphate) ;

Imports (guano and nitrates) in 1923 : 12 622 ;

Exports (guano, nitrates, ammonia products) in 1923 : 56 272 ;

Consumption (1922) : ammonium sulphate 159 222 ; sodium nitrate 33 831 ; guano 15 816.

Italy (1922) : Nitrogen produced : 6 700 ; Imported : 8 720 ; Consumed : 15 420.

During the war the cyanamide industry reached an annual capacity of 18 000 tons of nitrogen ; at present the output is a third of the capacity. There are two synthetic ammonia plants for the production of nitrogen by the Casale prooess and one by the Fauser. The consumption of nitrogenous products is less than before the war.

Norway : Production exceeds home needs for the atmospheric nitrogen industry is greatly developed owing to the low cost of hydraulic power. The following were exported in 1922 :

	Tons
Fish meal and guano	6 734
Calcium nitrate	157 562
" cyanamide	3 892
Sodium nitrate	32 402
?	1 673

The war led to a considerable increase in the exportation of nitrogen, causing a rise of from 16 829 in 1913 to 29 562 in 1916 ; in 1922, 21 890 tons were exported.

The following are the figures for other European countries :

	Tons of fixed nitrogen — Imported	Tons of fixed nitrogen — E:ported	
Sweden	6 011	1 763	(1923)
Spain	17 200	—	(1922)
Switzerland	1 335	470	(1923)

For Belgium, Denmark and Holland the article gives the data supplied by the International Institute of Agriculture. A. F.

562. **The Action of Manganese Sulphate in the Mineralisation of Nitrogen.**

LEONCINI, G. and ROGAI, F. A. (R. Istituto di chimica agraria di Pisa). Saggi sull'azione nel terreno del solfato manganoso nella mineralizzazione dell'azoto di alcune sostanze proteiche. *Le Stazioni Sperimentali Agrarie Italiane*, Vol. LVII, parts 7-9, pp. 282-295, 3 plates. Modena, 1924.

Though it be admitted that manganese conpounds added to the soil may act as oxidising catalysers in one of the various chemical and biolo-

gical processes which take place in the soil, nothing can be foreseen as to the possible influence of such compounds on the complex bacterial process by means of which the nitrogen of the protein compounds is reduced to ammonia. A slow release of oxygen through the agency of the manganese compounds might be useful in the decomposition process and accelerate the production of ammonia. Whether it is a question of a true catalyptic influence or of a stimulating or depressing action by the Mn-ion, can only be ascertained by experiment.

From preliminary tests in aqueous solutions of urea, asparagine, acetamide, and meat peptone, the authors have observed that manganese dioxide or salts (manganese sulphate or chloride) do not favour the formation of ammonia.

From tests made in clay and sandy soils, the authors have observed that manganese, added as manganese sulphate, has no influence, either beneficial or detrimental, in the reduction of organic compounds present in dry blood or albumen, and in the mineralisation of nitrogen, dry blood and albumen. It may therefore be concluded that manganese takes no part in the bacterial process and that consequently there is no beneficial action by the catalyptic properties of the manganese compounds, nor any physiologically stimulating action by the Mn-ion.

Manganese is in nowise concerned with the continuance, on the other hand, of mineralised nitrogen accumulated in the soil in consequence of the reduction of albumen and dry blood, whereas it seems that a preservative influence may be attributed to the SO_4-ion. A. F.

Agricultural Botany, Chemistry and Physiology of Plants.

563. Investigations on the Environmental Conditions which Influence Plant Life, made in the Laboratory and Experimental Ground of Prof. Dojharenko at the Moscow Agricultural Academy.

I. — DOJHARENKO, Prof. A. G. Physical methods applied to the experimental study of agricultural questions (Agro-physicheskie metody laboratornago izuchenia voprosso polevodstva). *Nautchno Agronomischeski Zhurnal* (Journal of Agronomic Science), Year I, No. 2, pp. 99-114, figs. 12, diag. 1, Moscow, 1924 (received January, 1925).

II. — DOJHARENKO, Prof. A. G. The Utilisation of Solar Energy for Field Crops (Ispolzovanie solnechnoi energii polevymi kulturami). *Ibidem*, No. 1, pp. 7-21, fig. 1, diagr. 1, plates 7.

III. — DOJHARENKO, Prof. A. G. Soil and Subsoil Permeability and its Importance to Field Fertility (Vodopronitzaemost potchv i gruntoff kak faktor plodorodia polei). *Ibidem*, No. 4, pp. 259-268, fig. 3, diagr. 1, pl. 4.

IV. — TROFIMOFF, A. B. Some Results of Investigations on Soil Permeability on the Experimental Ground of the Agricultural Academy (formerly known as the Petroffskaya. Agr. Academy) (Niekotorye resultaty izuchenia vodopronitzaemosti potchvy na opytnom pole selsko-khosiastvennoi (b. Petrovskei Akademii). *Ibidem*, No. 4, pp. 269-273, 3 plates, 1 diagram.

V. — DOJHARENKO Prof. A. G. Investigation on Soil Evaporation (K izu-

cheniu ispariaiustchei sposobnosti potchvy). *Ibidem*, No. 5, pp. 339-374, fig. 1, pl. 4, diagr. 1.

VI. — KUDRIAVTZEFF A. Oxygen and the Roots of Plants. (Potrebnost kornei rastenii v. kislorode). *Ibidem*, No. 1, pp. 48-67, figs. 2, diagr. 1, pl. 14.

VII. — KUDRIAVTZEFF, A. The Transformation of Nitrogen compounds in the Soil and their Relation to Nitrification, (Prevraschenie form azota v pocthve v sviazi s nitrificatziei). *Ibidem*, No. 4, pp. 297-311, diagr. 4, pl. 6.

I. The principle that the improvement of agricultural technique should be based on exact knowledge of, and, as far as possible, on the quantitative determination of the factors which are concerned in plant life and that may be modified by cultivation processes, induced the author, in his laboratory and on the experimental grounds annexed thereto, to undertake a series of investigations intended to include all the factors which determine soil fertility and influence plant-life development.

The author divides these factors into three categories. The most essential are 5 in number, air, water, mineral and organic nutrients, light and temperature. The secondary or indirect conditions are : soil structure, stability, biological activity and decomposition of organic matter. In the third category the author ranks adverse influences : plant diseases and pests.

Each of these subjects for investigation is subdivided into several heads, the majority of which required preparatory work for the choice of methods. Indeed, while as regards some questions the methods were amply developed and perfected, there were many which could not be sufficiently investigated by existing methods, while in the case of others, which had not yet been touched, the author had to begin by finding the appropriate method of investigation. Thus, it was possible for him to adopt the chemical methods applied to the study of plant nutrition, almost without modification, whereas for questions which can only be solved by the application of physical methods the author had to trace out a new way and invent the apparatus necessary for the investigations.

As a guide in the investigations the author drew up the scheme which is given below : among the applied methods as given in the third column, those which were worked out by the author and his collaborators are marked by an asterisk :

Fundamental factors	Questions to be solved	Methods
Water	Hygroscopicity Distribution (depth) Permeability Evaporation Capillarity	Weighing Electrometric Alcoholic * Pyknometric Hydrometric * Psychrometric * Potometric *

Fundamental factors	Questions to be solved	Methods
Aeration	Atmospheric reserve, its composition. Interchange of gases Diffusion Thermic respiration of thc soil Porosity Permeability to air	Absorption and pumps * Eudiometric * Hydrostatic * Pyknometric * Potometric. *
Nutrition	Reserve of N, P, and other elements Their distribution (depth) Their compounds Exchange and transformation Soil extracts Osmotic pressure Concentration Electric dissociation Colloids Acidity	Calorimetric * Fractional hydrolysis * Oil emulsion * Cryscopic Electric conductibility Interferential * Electrometric (concentration of H-ions)
Biological activity the of soil	Evolution of CO_2 Microbiologic reactions Number of bacteria Change in the microflora Formation of spores	Absorption by plate cultures by the Hiltner and Remy method Fractional sterilisation
Decomposition of organic substances	Organic compounds Their distribution (depth) Haulm residues	Hydrolytic * Leaching
Soil structure and stability	Capillarity and interstics Soil fixation	Pyknometric * Gelatine treatment Freezing
Solar energy	Coefficient of energy utilised	Calorimetric
Infection of fields	Infection of the soil » » of seed » » of crop	Solution of DRUDE, MALTZW, PKAUN KIER Weighing * Analytical control
Crop	Estimation of yield » » of quality	Mathematical Analytic control

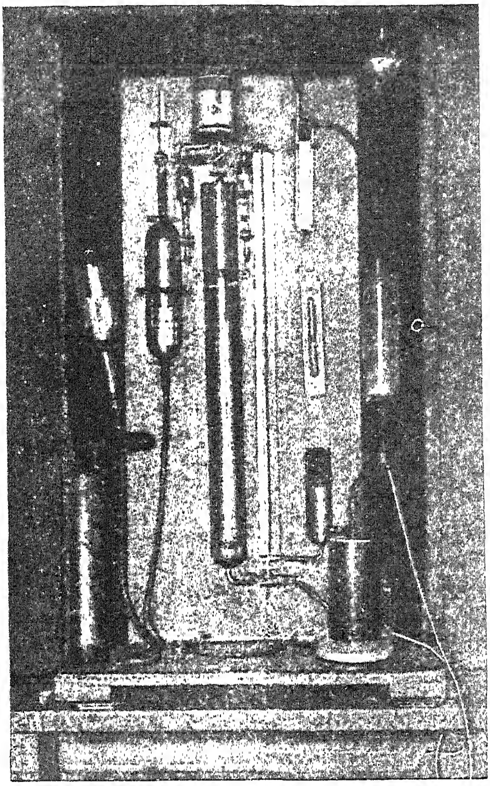
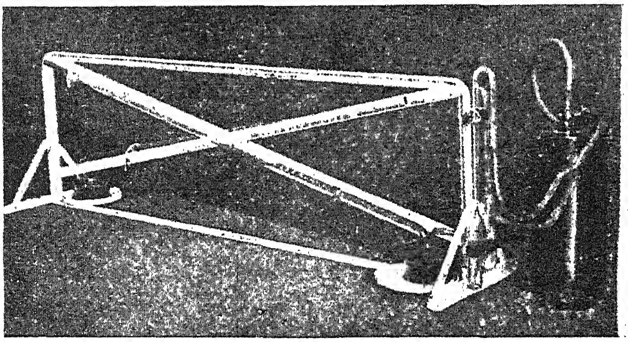


FIG. 118. — Apparatus for determining the amount and composition of air in the soil (Constructed by Prof. A. DOJARENKO).



FIGS. 119 and 120. — Apparatus for determining the interchange of gases, between soil air and atmospheric air, soil respiration. (Constructed by Prof. A. DOJARENKO and A. TROFIMOFF).

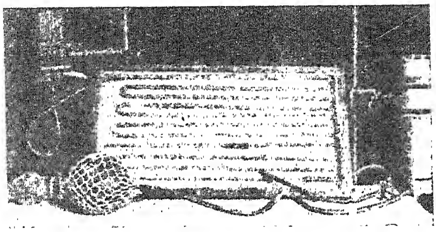


FIG. 121. — Apparatus for determining soil permeability to air. (Constructed by Prof. A. DOJARENKO).

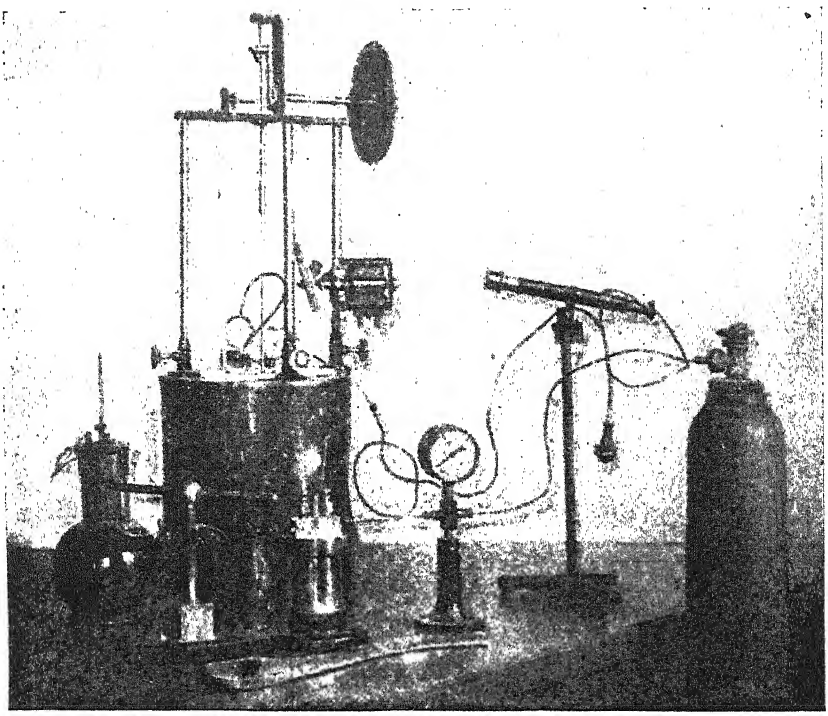


FIG. 122. — Apparatus for calorimetric determinations. (Constructed by Prof. A.

For hygrometric investigations the author has worked out two new methods for determining soil moisture, which though less exact than those usually employed, have the advantage of enabling very rapid determinations over large areas to be made, and at the same time of indicating soil porosity. One of these methods consists in comparing the concentration of an alcohol solution before and after mixing it with a soil sample. The second, the pyknometric method, is based on the comparison of the specific weights of two soil samples of which one is perfectly dry. In the investigation on hygroscopicity the author attributes the greatest importance to soil permeability, soil evaporation capacity and capillary activity, for these three factors may be most easily modified by cultivation.

An apparatus constructed by the author is shown in Fig. 124.

This apparatus, which can be used in the open field, enables the speed of the penetration of water into the soil to be measured at the moment when the imbibition current attains a constant speed, which happens when the soil is completely saturated with water; by it also this measurement can be made at various horizons in the subsoil.

Soil aeration had hitherto been very little studied. The author has made a series of researches on this subject by original methods and by means of an instrument which he invented to determine the air reserves in the soil and their composition. This apparatus is shown in Fig. 118 By it the total air contained in a soil sample may be extracted by aspiration, the natural structure of the soil having remained intact, and afterwards the gases obtained are analysed to determine their oxygen and carbonic acid content. These tests have shown that the quantity of oxygen in the soil is exceedingly variable and that the lack of oxygen may become so pronounced that the failure of crops may often be attributed to this cause. The tests having shown that the oxygen reserves of the soil only suffice for eight days at the most, the interchange of gases between the soil and the atmosphere is necessary for the success of crops. This exchange, considered by the author as a process of soil respiration, is carried out by the diffusion, conversion, and imbibition of water. To measure the extent of these processes the author applies the eudiometric and hydrostatic methods and employs the apparatus shown in Figs. 119 and 120, with which the quantity of air set free and absorbed by the soil may be determined in the open field and thus the soil respiration measured.

The soil's permeability to air depends on its non-capillary interstices which is measured by the manometric method, determining the speed with which the pressure is communicated, or by the potometric method from the speed of the movement of the air-bubbles in the instrument shown in Fig. 121, driving the air through the soil under a determined pressure.

In order to study the atmospheric air and measure the increase of carbonic acid content, an aerodynamic method is employed, by which the composition of the air in these various atmospheric layers may be determined.

Plant nutrition is examined by the calorimetric method, with certain improvements. To obtain soil solutions an emulsion is prepared by mixing the soil sample with the oil, which is afterwards removed by means of a centrifugal apparatus. The solution is then studied to determine: (1) the osmotic pressure, (2) electric conductibility, (3) dissociation by electrolysis, (4) concentration of hydrogen-ions, (5) nutrient substances content and the forms under which they are present.

Soil structure and stability are expressed quantitatively by the relation between the capillary and non-capillary porosity of the soil, which determines the dynamics of every process which takes place in the soil. These two kinds of porosity are measured by the pyknometric method. The stability of the soil structure is measured by means of an apparatus which determines quantitatively the dispersion of the sample in water. The author also carries out tests with a new instrument for taking soil samples at different depths without altering the soil structure.

The biological activity of the soil is also examined by new methods, which are still in course of preparation. The final result of all these investigations is summarised in the last problem examined by the author in his researches on the utilisation of solar energy. In this case the method of actinometric observations is employed for determining the quantity of energy imparted to the fields by solar radiation, and the calorimetric method for estimating the quantity of this energy stored up in the crops; the relation between these two values gives the coefficient of solar energy utilised.

II. The author considers that one of the most important problems is to determine which crops can be màde to store up the greatest quantity of solar energy in the form of organic substances utilisable for human consumption, and what methods of cultivation will serve to increase the quantity of energy stored up by each crop. The practical importance of this question will be readily grasped, especially when it is considered that the sun is the primordial generator of all energy on our planet and that the quantity of its energy available is necessarily limited. But before being able to exercise any influence on the quantity of solar energy absorbed by plants, which are the sole collectors of the said energy, the quantitative investigation of the process of its accumulation in the plants is obviously necessary. The author has been engaged on this investigation for about ten years.

The quantity of solar energy available varying for each species of plant according to its structure, the space it occupies, and other factors, the author has chosen 11 species of widely cultivated plants for his researches. For each crop the total radiated energy was ascertained by the actinometric method, and to find that which the plant had stored up, the number of calories in the dry matter were estimated.

This dry matter was reduced to a fine powder and then made into a cake, which was placed in a calorimetric bomb filled with oxygen, on the BERTHELOT-KRAKER-MUELLER system, and complete and instantaneous combustion was caused by an electric spark.

Fig. 122 shows the instruments used for these tests i. e., the press for

making the cake, the calorimetric bomb, the manometer for determining the pressure of oxygen, the two GRENET elements, the water calorimeter with its stirring rod, a thermometer and the lens for taking these readings.

These observations showed that the average number of calories annually radiated over an area of one hectare was 3863 millions.

For the 11 crops examined, the number of calories available varied from a minimum of 1628 millions for lupins to a maximum of 2501 millions for beet. But the number of calories actually accumulated in the various crops was only a maximum of 77.5 millions for the lupins and a minimum of 47.7 millions of calories per ha. for beet. The quantity of calories absorbed is therefore very small as compared with the quantity available; in the tests this proportion varied from a minimum of 1.91 % to a maximum of 4.79 %. This proportion, called by the author *coefficient of utilisation* of the solar energy by plants, is expressed in the following figures for the various crops tested:

Mangels	1.91 %	rye	2.42 %
sugar	1.94 »	wheat	2.68 »
turnips	1.95 »	oats	2.74 »
vetch	1.97 »	flax	3.01 »
clover	2.18 »	lupins	4.79 »

It should be noted that the crops which store up most calories are oleaginous; next come those rich in albumen, while the other substances — starch, sugar and cellulose — only differ from one another slightly from the calorimetric point of view. The diagram shown in Fig. 123 shows the distribution over the 12 months of the year for 4 consecutive years of the calories radiated per ha., the quantity of calories available for each crop (the average for the same years), that which was really absorbed by the plants, and finally the percentage of the corresponding coefficient of utilisation. Two supplementary items of information on rye and wheat are also to be found in this diagram, regarding their absorption of calories during the most intense period of growth, i. e., from the termination of tillering until earing. During this period wheat absorbed 8.78% of the available calories, and rye, 7.58 %. It will be readily understood, that the plant absorbs different quantities of calories at different phases of growth according to the surface presented by its foliage and the intensity and nature of the vital processes which take place in its organism.

The author therefore distinguishes the coefficient of utilisation calculated on the average during the growth period, which he calls *average technical coefficient*, from the corresponding figure at the moment when the vital processes are most intense, and which he styles *maximum technical coefficient*. Regarding the use of the word "technical" in these denominations it is explained by the author's intention to distinguish, on the one hand, between the energy transformed by the plant into organic matter and thus stored up in the form of calories available for subsequent utilisation, and on the other hand, the quantity (much larger) of energy absorbed by the plant, a part of which is utilised by the different vital processes. The relation of this total energy absorbed by the

plant to that which was available, is named by the author "the *physiological coefficient*".

Now, it must be mentioned that not only the quantities of energy expressed by the physiological coefficient and the maximum technical

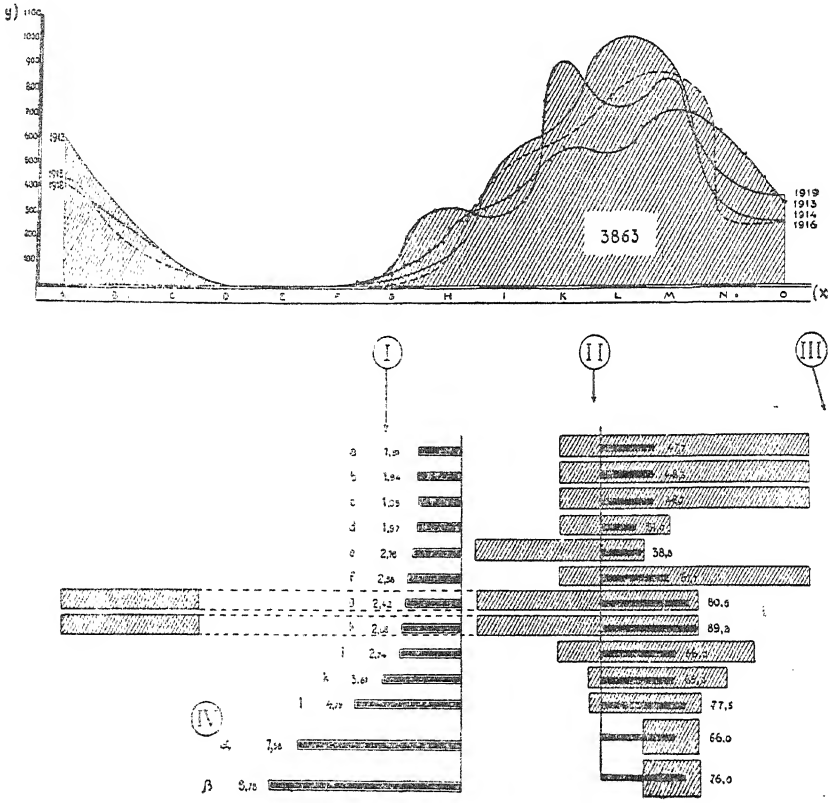


FIG. 123. — Diagram showing utilization of solar energy. The abscissae indicate months of the year and the ordinates the solar energy irradiated per hectare, in millions of calories. The curves indicate the years 1913, 1914, 1916 and 1919.

A = August	E = December	I = April	N = August
B = September	F = January	K = May	O = September.
C = October	G = February	L = June	
D = November	H = March	M = July	

3863 = Average annual solar energy per hectare, 3863 millions of calories.

I. — Average technical coefficients of solar energy utilised, as percentage of energy at disposal of crop. *a* = mangel, *b* = sugar beet, *c* = turnips, *d* = vetch, *e* = clover, *f* = potatoes *g* = rye, *g* = wheat, *i* = oats, *k* = flax, *l* = lupins.

II. — Total energy accumulated during the harvest in calories per hectare.

III. — Total solar energy available for crop during growth period.

IV. — Technical coefficient, maximum 6 ½ %.

α = rye during month of June, β = wheat during June.

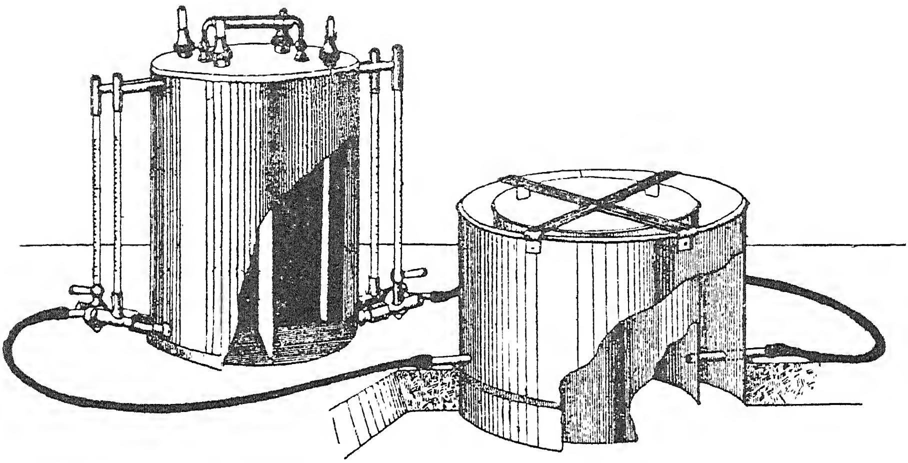
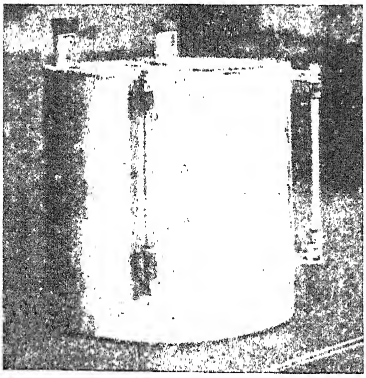


FIG. 124. — Apparatus for determining soil permeability to water.
(Constructed by Prof. A. DOJARENKO).
General view of apparatus with method of supply.



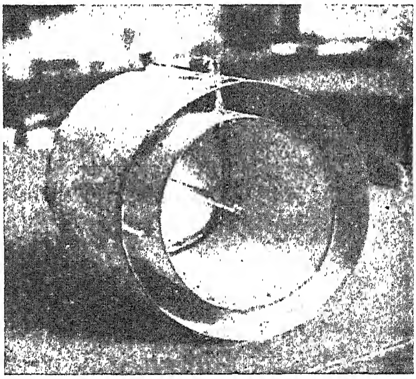


FIG. 125 and 126. — Apparatus for determining soil permeability to water.
(Constructed by Prof. A. DOJARENKO).

External view of apparatus. Internal arrangement of apparatus.

coefficient, but also those which correspond to the average technical coefficient, are much greater than the quantity which is utilised by the grower in the form of substance or calories. The author's coefficients indeed are calculated on the total dry matter of the plant, contained in its aerial and subterranean parts, whereas the grower only utilises a part of it. To complete the investigation therefore, that portion of accumulated energy which is really utilised by man for each crop, must be determined.

The solution of this question forms the object of the author's present work, which aims at estimating the calories accumulated separately for each part of the plant and for each kind of crop. It is hoped in this new investigation to find the elements for the solution of a practical question of great importance. The great difference between the average and maximum coefficients leads one to suppose that it would be possible to obtain a more complete utilisation of solar energy by means of the mixed cultivation of different kinds of crops which are simultaneously at different stages of growth.

III. — Soil permeability which renders the soil capable of absorbing, distributing and holding water, is certainly an important factor in fertility. A very simple apparatus enabled the author to determine quantitatively, soil permeability by the speed of water imbibition. Fig. 124 shows a general view and the internal arrangement of the apparatus.

As this apparatus can be used in the open field at any required spot, it suffices to remove the upper layers over a small area in order to measure permeability at each horizon. This process has enabled the author to measure the permeability of the arable layer, the podzol and the subsoil. In measuring the permeability of several superimposed layers, the final result obviously depends on the speed of imbibition by the layer which is least permeable ; it suffices to wait until this speed becomes constant.

The experiments have shown that there is always a very close relation between soil fertility and permeability. Thus, a yield of 5.5 lbs. of dry matter per sq. "sazhen" (about 49 sq. feet) in a crop of oats, corresponded to an imbibition speed of 5.5 cubic cm. of water per hour. The figures corresponding to changes of permeability are as follows :

Speed of Imbibition	Yield
5.5	5.5
6.5	8.0
13.06	10.0
37.14	24.75
30.05	36.20

According to the experiments, soil permeability depends especially on the lower layers. Indeed it was always possible to impart the desired permeability to the arable layer by cultivation. It is not so much the composition of the soil, however, which determines permeability, as soil structure. Permeability depends much more on the non-capillary interstices than on capillarity properly so-called. Thus the podzol, though

sometimes containing much colloidal matter, may be very permeable if perforated by roots, animals or fissures and crevices of mechanical origin. In these cases deep ploughing may become injurious as by obstructing the orifices of the interstices it decreases permeability. Greater permeability can be imparted to the deep layers of subsoil only by means of drainage, but often mere veins of sand act perfectly as drains, even in the most impermeable clays.

IV. — The author, who worked under the direction of Prof. DOJARENKO, on the determination of permeability, gives particulars of the process adopted in these tests. In view of the influence of water on the soil particles, the composition of the water used in the test is not without its importance, and it is recommended that none but rain-water should be used. If the soil shows great permeability, it is not always possible to prolong the experiment until the speed of imbibition becomes constant owing to the great quantity of water which would have to be employed. In this case the permeability can be measured after the apparatus has been working one hour, for then the decreased speed of imbibition always becomes insignificant. In raising the upper layers of the soil care should be taken not to break into the structure of the surface of the layer to be measured, for the obstruction of the orifices of the non-capillary interstices, even though quite superficial, is often sufficient to cause errors in the results of the experiment.

V. — The fact that scientific surface cultivation tends to eliminate useless evaporation is well known, and has been applied in a whole series of methods of cultivation in connection with " dry farming ". Feeling convinced that it was impossible to perfect these methods without carrying them out on a quantitative basis, the author undertook his tests in order to measure the speed of soil evaporation, as compared with that of a surface covered with water. Investigations of this nature had already been made on soil samples in the laboratory, but more convincing tests were made in the open-field on soil particles in natural conditions. For these measurements a special instrument was constructed, shown in fig. 127. It is composed of a metal cone without a base, the edges of which are embedded in the soil. The air which penetrates into the cone above the soil passes through tubes, filled with calcium chloride, which dry it within 2.5 mm. of complete saturation. The air is driven into the apparatus by means of a suction ventilator fixed at the end of a tube inserted in the upper section of the cone and containing an ASSMANN phsychrometer. In this way the water evaporated by the surface of the soil was measured and collected by the cone.

The speed of evaporation depends on two factors : in the first place it is determined by the speed of the water's capillary ascension to the surface ; then the true evaporation capacity comes into play and is determined by the extent of the surface. With an equal surface, the soil liberates the same quantity of vapour as a layer of water, if the soil is brought to a state of perfect, and constant saturation. Certainly, under natural conditions the temperature, wind and hygroscopicity of the air also exert an influence on evaporation. But, under similar conditions,

a soil with a perfectly even surface should evaporate less water than a soil with an uneven surface, since the extent of the latter is necessarily greater. Now, the contrary generally takes place in the open field. The reason of this is that by breaking up the arable layer by ploughing, etc.,

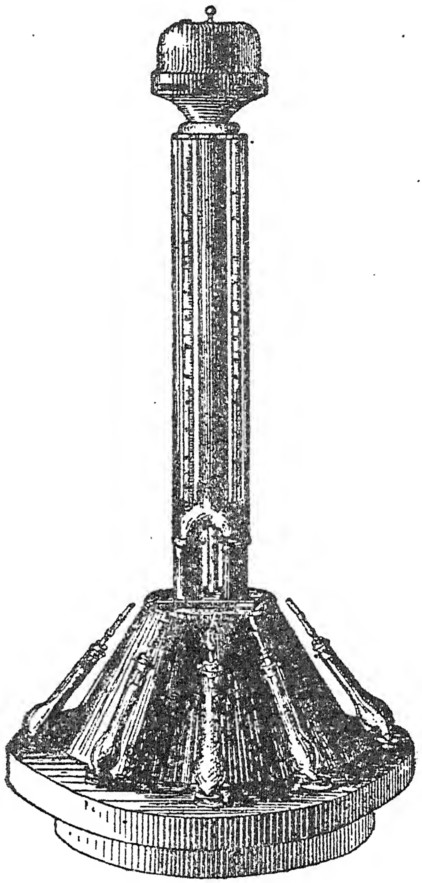


FIG. 127. — Apparatus for determining soil evaporation. (Constructed by Prof. A. DOJHARENKO). General view.

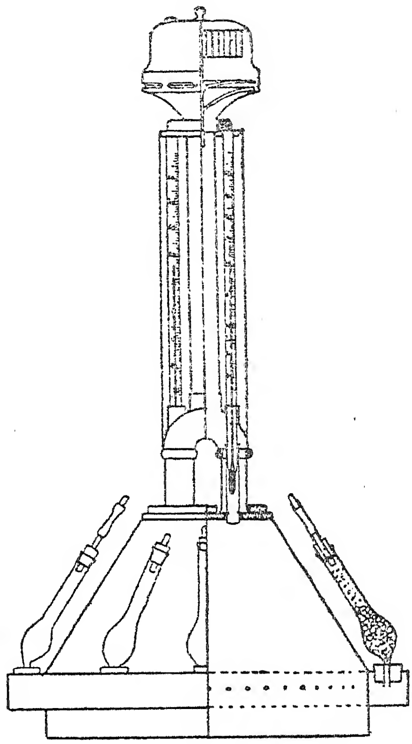


FIG. 128. — Apparatus for determining soil evaporation (Constructed by Prof. A. DOJARENKO) : Section.

the natural structure of the soil is destroyed, in which structure the capillary interstices communicate with one another uninterruptedly up to the surface crust, which facilitates the ascension of the water from the lower layers to the surface. The destruction of this continuity in

the capillary structure therefore explains the efficacity of surface cultivation in preserving the reserve of water in the lower layers.

Cultivation experiments showed that harrowing fallow land in spring decreases evaporation by 20.7 % ; ploughing combined with harrowing at the same period decreases evaporation by 50 % ; finally, if by continual ploughing the land is kept fallow, without vegetation and well broken up, evaporation is decreased by 59 %; these figures are expressed in comparison with those for evaporation in an uncultivated field.

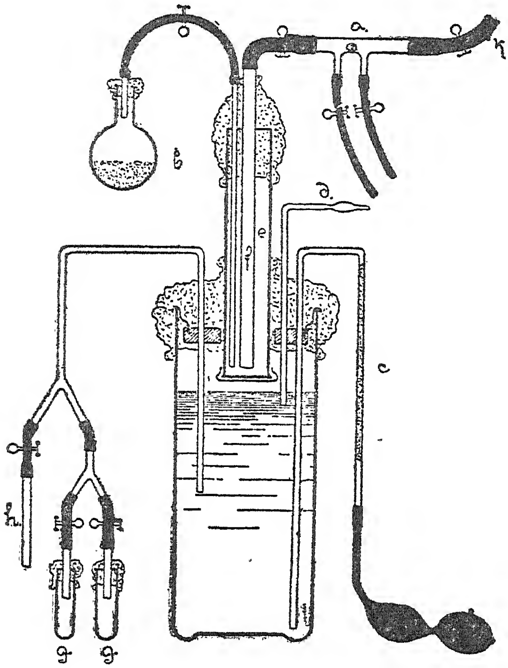


FIG. 129. — Plan of apparatus for determining the absorption of oxygen by plants under sterilised condit ions of cultivation.

Further investigations, now being carried out, aim at reducing the results obtained to a constant temperature, which will enable a surface of open water to be used for purposes of comparison, but in order to eliminate the temperature factor methodical investigations are still indispensable.

VI. — The necessity of aerating the soil and the absorption of oxygen by plant roots are well known facts. It is obvious that the root cells must consume oxygen, like all other living cells. But the tests for determining this process in the roots are generally based on the quantity of carbonic acid given off ; it was not taken into consideration that the results thus obtained could not be exact, since the carbonic acid formed might be the result not only of root "respiration", but also of a series of other chemical processes. Also, the methods followed did not enable the requirements of the roots in oxygen to be determined quantitatively.

In order to solve this problem aquatic plants were used, which were supplied with the necessary oxygen by insufflation in the nutrient solution. Similar solutions, subjected to the same treatment, served a-controls. Having observed, after a series of tests, that the nitrates cons tained in the nutrient solutions, became regularly transformed into nitrites also in the control solutions without plants, the author became convinced that the results were affected by the influence of micro-

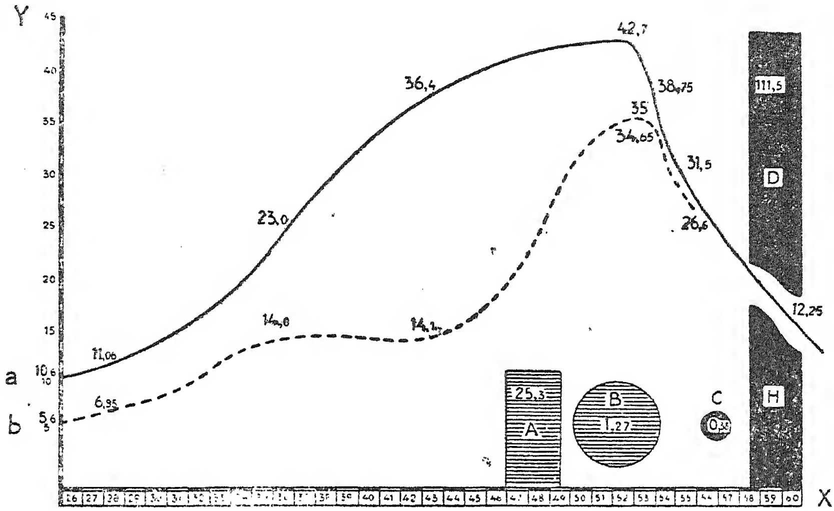


FIG. 130. — Diagram representing absorption of oxygen by plant roots in sterilised culture. The figures on the abscisa show duration of crop in days. The figures on the ordinate indicate the consumption of oxygen in milligrams per gram of dry matter.

The curve *a* relates to maize, curve *b* to peas. The black column shows yield in dry matter for maize D, and the column A the corresponding figures for peas. The circles B and C represent the average daily consumption of oxygen on thousands of grams per gram of dry matter, B for maize and C for peas.

organisms and further work is being carried out on perfectly sterilised plants.

The method applied to these plants, however, being very complicated and requiring extremely careful manipulation, the author was obliged to limit his tests to two species of plants, maize and peas. The apparatus used in these tests is shown in Fig. 129. These tests showed that the roots really consume oxygen in large quantities and that the plants die if their roots are deprived of it. The roots of maize and peas consume 0.38 to 1.37 mgms. of oxygen per gm. of dry matter in 24 hours. The curve expressing the consumption of oxygen attains its maximum during the flowering period (Fig. 130). An insufficient oxygen supply causes the roots to take up this gas from the oxygen compounds in the nutritive solution ; this process causes the formation of nitrous acid NO_2, and the transformation of the nitrates into nitrites ; in spite of this the plants are immediately attacked by chlorosis, for the processes of reduction prevent the absorption of iron by the plants.

Basing on a consumption of oxygen by the roots of 0.38 to 1.43 mgms. per day and per gm. of dry matter, it is estimated that with a good cultivation of a soil giving 50 % of aeration, the arable layer can take up a 10 % supply of oxygen, and that this reserve would only suffice for

10 days with a yield of 1000 puds (161 q.) of dry matter per ha. The presence of a sufficient reserve of air in the soil, however, is not sufficient proof that the total needs of the soil in oxygen will be satisfied, for the composition of the air in the soil is subject to considerable variations. It often does not contain more than 5 to 7 % of oxygen, which quantity is insufficient, as regards the needs of the roots, to carry out those processes of reduction which exert a great influence over the course of the whole biological activity of the soil.

The author is at present engaged on the study of this last problem.

VII. — It has already been long known that the soil nitrates accumulate when the soil lies fallow, and that they continue to increase in quantity until the winter sowings, and then rapidly decrease until they have almost entirely disappeared at the beginning of winter. The causes of this process are also known. They are: the absorption of the nitrates by the plants, the fall of the temperature, increase of humidity, decrease of aeration, variations in the composition of air in the soil and, finally, leaching. It is not proposed for the moment to examine all these processes. The object of the investigation is confined to ascertaining under what forms the nitrogen of the nitrates is extracted from the soil. Is decomposition complete on release of the pure nitrogen, or does this element enter into other organic combinations? The question is not without importance from the practical point of view, for if the nitrogen is released in a pure state it is definitely lost, and cultivation would tend to the systematic exhaustion of the fields. If on the contrary the nitrogen only passes from a mineral to an organic combination, even admitting that the latter is not available for assimilation, it will still be possible to convert it into a utilisable form. Fallowing therefore cannot be condemned *a priori* as a process of cultivation. It is also obvious that the properties of the new organic combinations of nitrogen are of great importance in determining the more or less considerable difficulty there may be in reconstituting the nitrates.

Placed in this light the problem presents itself under a double aspect. On the one hand the combinations of nitrogen in different soil types had to be studied, and on the other hand the dynamics of these combination in the soil, in connection with the progress of the biological processes which take place therein, had to be determined.

The tests for determining the transformation of the nitrogenous compounds were made by means of a fractional hydrolytic operation.

As regards the first part of the problem it was observed that the characters of the nitrogenous compounds are different in different soils; this difference is especially striking if the chernozem be compared with the podzol. In the chernozem the forms assumed by the nitrogen in its combinations are of great stability: the nitrogen is released with difficulty in the extracts, for it has a tendancy to accumulate in combinations which are very resistent to hydrolysis; even after boiling for 15 hours in a 20 % solution of sulphuric acid they do not decompose. The nitrogenous compounds in the podzol, on the contrary, are very unstable, decompose easily under repeated hydrolysis, contain a comparatively

large quantity of nitrogen soluble in acids, and only possess imperceptible quantities of forms which resist hydrolysis. Silt soils occupy an intermediary place between chernozem and podzol in this respect.

These results agree with the empiric indications of practical agriculture. The vital activity of the chernozem should always be aroused by cultivation, whereas in the case of podzol, cultivation tends to confine within certain limits its tendency towards a too strong mineralisation; nitrification is always more active in this soil, though the actual figures representing the quantity of nitrates formed are eventually higher in chernozem.

To solve the second part of the problem conerning the dynamics of the nitrogenous combinations, the following tests were made: A sample of soil deprived of nitrates was placed in conditions favouring the development of aerobes and afterwards analysed twice, the first time after 30 and the second after 100 days; then the same sample was placed in anaerobic conditions for 60 days and again analysed. Another sample containing nitrates was subjected to the anaerobic treatment and analysed twice, after 100 and 170 days.

The results show that in both cases the most important factor is the soluble nitrogen in the acids. In the samples placed in aerobic conditions, nitrates formed at the expense of the soluble nitrogen in the acids. In anaerobic conditions the nitrogen of the nitrates is transformed directly into compounds soluble in acids. The chemical processes of these transformations are very complicated, for, besides the soluble forms, other nitrogen combinations take part. In anaerobic conditions the general tendancy is to transform the staple combinations into other forms which decompose easily. In aerobic conditions the process proceeds inversely.

It follows from this that the disappearance of the nitrates in natural field conditions is not attended by a loss in nitrogen. Since anaerobic conditions cause the formation of nitrogen compounds, refractory to transformation, however, the reconstitution of the mineral compounds of nitrogen is necessarily rendered very difficult by the accumulation of these componnds. G. Z.

564. **Plant Production as a Measure of Environment.**

WEAVER, J. E. (University of Nebraska). *Journal of Ecology*, Vol. XII, No. 2, pp. 205-237, figs 14, plates 5. Cambridge, 1924.

The most important relation in plant ecology is the reciprocal one existing between the plant itself and its environment. Any attempt to determine exactly the causes which produce modifications in individuals and, consequently, in general growth, must include measurement of all the environmental factors. This must be done by means of instruments of precision, thus furnishing the bases for determining the ratio between the said stimulus. In this way however isolated data, difficult to interpret are obtained, whereas it is necessary to have an integral idea of environment, which can be given only by the living organism, *i. e.* the plant.

[564]

The object of the author's work is to analyse the intricate relations between plant and environment, so as to determine more exactly the effect of varying amounts of factors upon plant response. With this object in view, numerous plots measuring 1 metre square, were selected in typical areas in the climax vegetation. The height and density of vegetation, the abundance of the dominant and subdominant species, etc. were noted. The plants were then cut off level with the ground, air dried and weighed; the resulting datum represents yield. Numerous data, perfectly comparable one with another, have thus been collected, which may show the relative importance of the species predominating under various conditions.

The observations made covered a period of three consecutive years and were carried out in stations considered to be representative of the true prairie (*Stipa-Koeleria*), of the mixed prairie (*Stipa-Bouteloua*) and of the short-grass plains (*Bulbilis-Bouteloua*). At the same time the atmospheric and edaphic-ecological data were collected (rainfall, water and nutrient matter content of the soil, etc.). The yieldof cereals and grasses was also examined.

The most important factors on which yield is dependent are the relations between water on the one hand and soil and air on the other; the other factors are only accessory. The yield of pure stands of short grasses, wheat-grasses (*Agropyrum glaucum*), mixed short and tall grasses, and mixed tall grasses, was found to decrease from the true prairie through mixed prairie to short grass plains in direct relation with the available content of the soil and, inversely with atmospheric evaporation. The same relation was determined for oats, wheat and barley, and also for alfalfa, sweet clover and maize. In general it may be concluded that the wild and cultivated plants integrate the conditions of environment and through yield, express them quantitively. A. F.

565. **Factors Affecting Yield in Tropical Crops.**

I. HARLAND, Prof. S. C. Cacao: some Botanical Problems. *Tropical Agriculture*, Vol. II, No. 3, pp. 65-66. Trinidad, 1925.

II. CHEESEMAN, E. E. Fruitfulness. *Idem.*

I. A striking feature of a cacao plantation is the enormous variation in the yield of the trees, hence the importance to the planters of eliminating poor yielders. The barren trees produce flowers but do not set fruit.

The results of the author's experiments in Trinidad may be summarized as follows:

(1) Observations by the microscope have shown that only about 5 % of flowers ever receive any pollen on their stigmas.

(2) In the case of hand-pollinated flowers there is a setting percentage of 5 % as compared with 0.3 % in flowers not so pollinated.

(3) In the case of flowers visited by ants and aphides about 2 % of setting occurs. The examination of 4500 flowers shows that these insects are important factors in pollination.

Elimination of crawling insects by adhesive bands showed the presence of another pollinating agent, which pollinated about 1 % of flowers.

On certain trees hundreds of flowers were pollinated without one pod being set, whereas on other trees a large number always set. Hence, it is evident that some trees are good setters and unproductive trees are bad setters of fruit. It should be possible to breed a strain of good setters. Certain strains of cotton suffer from shedding of buds, flowers and young fruits, and it hs been possible to isolate strains comparatively free from this defect.

Employing the seed of high bearing trees will not ensure high bearing progeny, owing to natural crossing hence, the value of a tree for seed purposes can only be estimated by taking the average yield of its daughter trees.

II. Research has shown that the onset of the flowering and fruiting stages in plants is probably determined by the relative proportions of carbohydrates and nitrogenous substances in the tissues, or by some factor connected with the carbohydrate-nitrogen ratio. This ratio is in turn dependent upon the plants' constitution, nitrate supply, area of green surface exposed by the plant, and the relative lengths of day and night throughout its life history. W. S. G.

566. **Influence of the Duration of Light on Growth.**

ADAMS, J. (Central Experimental Farm, Ottawa). *Annals of Botany*, Vol. XXXVIII, No. CLI, pp. 509-523. London, 1924.

The author has tested 16 different species of plants, including wheat, rye, hemp, soy, the tomato, buckwheat, etc. Some of the plants were grown in the dark, others were exposed to the light for periods varying from 3 to 15 hours per day, others again were also exposed to artificial light, the total exposure being 20 hours per day.

At first growth followed more quickly in those exposed for a shorter period, but in the end the plants exposed for a longer period attained a greater altitude. It is concluded from this that growth, both in the light and in the dark, depends on the supply of reserve matter available for the formation of new tissues, and that, if two plants have the same quanity of this matter, that which is exposed to the light for a shorter period will grow more rapidly while the supplies last.

Plants which grow with less light are deficient in mechanical tissue and tend to droop, while the soy tends to become rampant; under these conditions the plants generally remain without branches.

The influence of electric light varies. From December to March (average period of light 9-12 hours), a further 9 hours' exposure at night with a lamp of 100 to 300 watts has a beneficial influence, fostering growth and hastening on the flowering period. From March to June, with more than 12 hours' light daily, the addition of a further 5-6 hours' artificial light has the greatest effect on buckwheat, whereas it does not hasten on the flowering period of spring wheat and the tomato, and retards that of soy; and hinders the attainment of height and weight by hemp. It seems that for the last-mentioned plants, the quantity of light which can be utilised by the plant is very limited, and that beyond this limit no further growth takes place. A. F.

[566]

567. Acidity Changes during the Growth Period of Wheat with Reference to Stem-Rust Resistance.

HURD, A. M. (Bureau of Plant Industry, United States Department of Agriculture). *Journal of Agricultural Research*, Vol. XXVII, No. 10, pp. 725-735, figs. 5, bibl. Washington, D. C., 1924.

The titratable acidity of the juice of the wheat plant undergoes a series of changes dring the growth of the plant from the seedling stage to that of maturity. There is a progressive decrease, to about a half, of the initial concentration, during the period of life beginning after the first fortnight and continuing until the expiration of 6 weeks. This period is followed by another of comparatively low acidity, with minor variations, which continues until the approach of maturity; after which acid concentration increases until maturity and drying. The final acid value may be double the seedling concentration and three time that of the period of owest acidity.

The hydrogen-ion concentration of the juice does not decrease appreciably between the ages of 2-6 weeks. It increases greatly during the period preceeding maturity and attains a comparatively high value at flowering and later.

The increased concentration of acidity during the last stages is connected with the decrease of water rather than the formation of seeds.

Titratable acidity and hydrogen-ion concentration are influenced by environmental conditions, which however vary very little as compared with the changes brought about by the growth stages of the plant, so that the general trend of acidity curve persists under all conditions.

Stunted plants are characterised by high acidity and hydrogen-ion concentration; the intermediate period of low acidity may not occur at all in them. Mildew infection also, when serious enough to show its influence on the plant, causes abnormally high acidity.

The high acidity of the juice does not prevent attacks of rust, while, on the other hand, low acidity does not predispose to this disease since the plant is not more liable to infection in one period than in the other. The resistent varieties pass through the same variations of acidity without thereby becoming less resistent. A. F.

568. The Irritant Action of various Chemical Products and its Effect on the Germination of Potato Tubers.

LOHMANN, J. (Institut für Pflanzenbau und Pflanzenzüchtung der Universität, Breslau), Reizwirkungen chemischer Verbindungen auf die Keimung der Kartoffelknollen. *Landwirtschaftliche Jahrbücher*, Vol. LXI, part I, pp. 1-44. bibl. Berlin, 1925.

The irritant action consists in a deviation of the normal course of vital activity caused by the influence of an external factor on the internal mechanism of the growing organism whereby a reaction of the organism itself is set up.

The favourable influence on the germination of the potato exercised by oxygen, ether and hot air, and the unfavourable influence of substances

containing copper, is to be interpreted in this sense; the injurious action of ferric sulphate on the other hand must be considered as a consequence of plasmolysis.

The influence of colloidal sulphur and "Uspulun" (a product with a chlorophenolate of mercury base, which shows evident influence on the *Rhizoctonia*) is doubtful. Sulphates and chlorides, in moderate quantity, may have a favourable influence on germination, but in larger quantities become injurious. In general however the duration of the contact has a greater influence than the concentration of the solutions, and this is so to such an extent that keeping the tubes in water for a certain time is sufficient to lower their germinative vigour.

Colloidal sulphur, hot-air treatment and Uspulun will perhaps be applied in practice; the last-named acts especially in a powdered form rather than in solution; it however injures the tubers if applied after germination has begun. A. F.

569. Effect of Nitrate Application upon the Hydrocyanic-Acid Content of Sorghum.

PINCKNEY, R. M. (Minnesota Agricultural Experiment Station). *Journal of Agricultural Research*, Vol. XXVII, No. 10, pp. 171-723, Washington, D. C., 1924.

The percentage of hydrocyanic-acid in green plants is in direct proportion to the nitrate used; the effects of the latter on the hydrodyanic-acid content continue after it has no longer any influence on the colour and size of the plant. In sorghum plants which are but slightly coloured, yellow or greenish-yellow, the hydrocyanic-acid is present in very small quantities or entirely absent, whereas in deep green plants it is present in quantities which are easy to determine; in such plants the hydrocyanic-acid is equally distributed in the stem and leaves.

Sorghum is thus a good indicator as to the presence of readily available nitrogen in the soil; it promptly responds not only by rapid growth and dark colouring, but also by a high hydrocyanic-acid content, which is higher in young plants. Only a few plants are required for an analysis, which may be made a few weeks after sowing. A. F.

570. Substances Similar to Insulin Eztracted from Plants.

GLASER, E. and WITTNER, L. (Chemisches Laboratorium des pharmakognostischen Instituts der Univ. Wien). Ueber die blutzuckerherabsetzende Wirkung von Pflanzenextrakten und Oxidasen sowie den Nachweis von Fermenten im Insulin. *Biochemische Zeitschrift*, Vol. CLI, No. 3-4, pp. 278-295, bibl. Berlin, 1924.

Substances possessing, like insulin, the power of decreasing sugar in the blood, may be axtracted from fungi and turnips. As however by the methods used for extracting such substances, the ferments may also be extracted, the authors extracted these latter (peroxidases and catalases)

and observed that they have a marked influence in decreasing sugar in the blood, and that the purer they are the greater this influence.

But in insulin, ferments are to be found, such as peroxidases, some of which act in a contrary manner. The decrease of sugar in the blood may therefore perhaps be due to the action of such ferments. Their effect, like that of insulin, is destroyed by mineral acids and by tryptic digestion. A. F.

571. Absorption of Urea by Fungi.

IVANOFF, N. N. (Institute of Plant Physiology, Petrograd University). Die absorption des Harnstoffes durch Pilze. *Biologische Zeitschrift*, Vol. CL, Nos. 1-2, pp. 115 - 122. Berlin, 1924.

Fungi absorb the urea of the respective solutions and accumulate it up to 14.0 % of the dry weight of the pileus. The accumulation is more evident in the hymenium of the receptacle, where the spores are formed.

The thio-urea is also absorbed by the receptacle, but only by a further treatment, since, if urea be added to the thio-urea solution, only the urea is absorbed.

The *Bolbitius vitellinus*, which contains urease, does not accumulate urea because the latter is quickly decomposed by the urease, whereas on the other hand this fungus can accumulate thio-urea, on which urease has no influence. A. F.

572. The Function of Nicotine in the Tobacco Plant.

THERON, J. J. and CUTLER, J. V. (School of Agriculture, Potchesftroom). *South African Journal of Science*, Vol. XXI, pp. 189-194, tables 4, figs. 2. Cape Town, 1924.

Alkaloids have been described as excretory or waste plant products, protective agents and storage products. Notwithstanding the poisonous character of nicotine to the animal organism, it fails to protect the tobacco plant against the attacks of eelworms, aphides and bacteria. The authors are of opinion that nicotine is stored in the plant as a nitrogenous food, and is not merely a waste product or a protective agent. Their investigations enabled the following conclusions to be drawn:

The total nicotine per acre and the percentage per plant increase up to the flowering stage, after which there is a rapid decrease. The formation of seed has the immediate effect of reducing the percentage of nicotine per plant. If seed formation be prevented nicotine tends to increase, rather than decrease. In order to effect an increase both in the yield of nicotine per acre and the percentage per plant, the crop must be manured with phosphatic and potassic fertilisers, in addition to nitrogenous fertilisers.

The importance to the grower of these facts is that, whenever tobacco is grown for nicotine, the life processes of the plant should be interrupted as soon as possible after the stage is reached where the plant contains the maximum amount of nicotine. Unless the plant be killed as soon as possible after harvesting, there is a decline in nicotine content. On the

other hand, smoking tobacco should be so treated that the plant organism itself removes any excess of nicotine that may be present in the leaves.

W. S. G.

573. **The Presence of Substances similar to Insulin in Beans.**

EISLER, M. and PORTHEIM, L. (Staat. serotherap. Institut und Biolog. Versuchsanstalt der Akad. der Wissensch. in Wien). Ueber insulinartige Stoffe aus Bohnen und deren Wirkung auf den Kohlenhydratstoffwechsel. *Biochemische Zeitscjrift*, Vol. CXLVIII, Nos. 5-6, pp. 566-572. Berlin, 1924.

The authors have isolated from an extract of beans (*Ph. multiflorus* and *Ph. vulgaris*) an alcoholic precipitate which, like insulin preparations, contains an active principle capable, of diminishing the sugar in the blood of rabbits, of accelerating the scission of the starch and favouring diastatic fermentation.

The pure extract also has the property of reducing the sugar in the blood, but has an obstructive influence on the enzymes. This influence may probably be attributed to those portions which are soluble in alcohol.

A. F.

Plant Breeding and Seeds.

574. **A Programme of Maize Improvement.**

WOODWORTH C. M. *University of Illinois, Agricultural Circular* No. 284, pp. 24, figs. 12 Urbana, Ill., U. S. A., 1924.

The author draws attention to the need of improvement in maize breeding and in this Circular gives suggestions for the production of better strains. Two methods of improvement are given, selection, and the pure-line methods. The characteristic of good seed areas are stated and illustrated by photographic reproductions.

The importance is emphasised of co-operation between the Experiment Station, the plant breeder, the seed producer and the maize grower.

W. S. G.

575. **Comparative Tests of Six Philippine Maize Varieties.**

MARQUEZ, F. D. *Philippine Agricultural Review*, Vol. VII, No. 3, pp. 195-201, tables 3. Manila, 1924.

The comparative tests of varieties of native maize were made by the author from 1919 to 1921. The varieties compared were: Bohol White Flint, Cebu White Flint, Moro White Flint, Baluga Yellow Flint, Cazayan Yellow Flint, Calamba Yellow Flint.

The Baluga Yellow Flint was the highest yielder and gave during three seasons, 31.38, 41.65 and 27.57 cavans shelled maize per hectare, respectively (1 cavan of maize = 0.585 q.). This variery was uniform and early maturing.

Baluga Yellow and Cebu White did best during the dry season. Calamba Yellow was a good wet season variety. Moro White was least susceptible to soft-rot disease and stalk and ear-bororers, while Cebu White was most susceptible.

W. S. G.

576. **Machine Winnowing of Paddy Seed.**

Bulletin Economique de l'Indochine, Triage mécanique des semences de paddy. Year XXVII, VI, No. 169, pp. 621-638. 1924.

With a view to improving rice crops in Indo China the "Société française des Distilleries de l' Indochine" have undertaken tests in machine winnowing of seed in their rice plantations at Hanoi. The Company, by placing their material at the service of the rice growers anxious to improve their seed, hope to arrive at useful results. The tests made are encouraging, and they are being continued. The Government of Cochinchina intends to furnish that country with a set of machines similar to those used at Hanoi. *Corr. Indo-China.*

577. **The Effect of Dry Heat on Alfalfa Seed and its Adulturants.**

STAKER E. V. *Journal of the American Society of Agronomy*, Vol. VII, No. 1, pp. 32-40, tables 5, bibliography. Geneva, N. Y., 1925.

The author's investigations were carried out on various seeds heated in soil, water, in atmospheres of different humidities, carbon dioxide, ether, carbon disulphide, and dry air; the present article, however, deals only with the effects of dry heat on seeds.

The investigations indicate that heating commercial alfalfa seed at temperatures from 60° to 90° C., increased the percentage of germinatlon, 60° being as effective as 90° C. The increase was attributed to reduction in the number of hard seeds. Light green or yellow seed is more responsive to heat than brown seed. Russian thistle and white tumbleweed seeds were killed when heated for four hours at 85° to 90° C., and seeds of dock and buckthorn were injured.

The author is of opinion that dodder can be controlled by heating alfalfa containing dodder seed to a temperature of 85° to 90° C. for four hours, but furher experiments are necessary before this can be confirmed.

W. S. G.

CROPS IN TEMPERATE AND TROPICAL COUNTRIES.

Cereals, Roots and Forage Crops

578. **The Manuring of Grass Land for Hay at Rothamsted.**

SMITH, Dr. W. G. *The Scottish Journal of Agriculture*, Vol. VII, No. 3. pp. 257-264. Edinburgh, 1924.

These experiments were started in 1856 and have been carried on continuously.

The conclusions to be drawn from these experiments are too numerous to be brieflfy summarised, but the following are of special importance:

It is unprofitable to leave enclosed grassland unmanured. The foundation of grassland manuring is phosphates and to some extent potash, which alone will produce good grazing land, although they do not encourage the bulkier grasses that give hay. High yields of hay are obtained by the application of 4 to 6 cwt. per acre of sulphate of ammonia or 2 ½ to 5 cwt. of nitrate of soda, but these do not favour good grazing, as the growth of rank grass injures the bottom grasses. Half the quantities would better suit the grazing herbage.

Bent grass (*Agrostis vulgaris*) increases with starvation and farmyard manure, and is decreased by superphosphate and by lime. Yorkshire fog (*Holcus lanatus*) is indicative of one-sided nitrogenous manuring, or lack of potash. Sweet vernal grass (*Anthoxanthum odoratum*) is encouraged by ammonium salts. Foxtail (*Alopecurus pratensis*) responds to good manuring if lime is maintained. The chief leguminous plant, yellow vetchling (*Lathyrus pratensis*), is reduced by starvation or nitrogenous manuring.

W. S. G.

579. **Silani, a new Cover and Forage Crop.**

HARLAND, Prof. S. C. *Tropical Agriculture* ,Vol. II, p. 74, No. 4. Trinidad, 1925.

Vigna Marina, M., known in the Philippines as Silani, is a perennial plant with yellow flowers and small pods of 4 to 7 cm. in length. Seeds are produced sparingly, but the plant may easily be propagated from cuttings.

Silani cut as green forage is readily eaten by animals, and also forms a good leguminous cover crop. The plant does not tolerate well a long dry season.

Planting should be done during the rainy season, using cuttings about 60 cm. in length. When established the growth is rapid and vigorous.

W. S. G.

580. **Rain Grown Cotton and Climate.**

CANNEY, E. E. (British Cotton Research Association). *Journal of the Textile Institute*, Vol. XV, No. 12, pp. 533-542, maps 3, bibliography. Manchester, 1924.

The main supplies of short staple cotton of the American types have always been grown under rainfall conditions and in studying extensions of the cultivation of these types, without irrigation, climate is the most important factor, as cultivation, drainage, labour, transport, etc., can all be controlled by human agency, which is not the case as regards climate.

The author discusses suitable climatic conditions for a rainfall crop of cotton and suggests that excessive rainfall, cloudiness and insufficiency of sunshine during the maturation period must be as closely studied as water supply and temperature. Special attention is drawn to the necessity for abundant sunshine and to the detrimental effect of overcast skies. As

cloud condition does not always coincide with the amount of rain, rainfall data alone are not sufficient.

The meteorological limits to successful cotton-growing are assumed to be as follows:

(1) A mean annual temperature of at least 60° F., or where rainfall, sunshine and temperature are very favourable, over 50° F.

(2) A minimum annual rainfall of 20 inches, with a maximum of 60 inches, rising perhaps to 75 inches if very favourably situated.

(3) areas recording « half-cloudiness » annually are assumed to have insufficient sunshine, and those with « three-fifths cloudiness » to be very unsuitable.

Three maps are appended to the article: (1) shows areas unfavourable from various causes and emphasises the fact that the Tropics are not favoured with such clear skies as is often supposed; (2) shows the areas remaining after eliminating those with two inhibiting factors; (3) is an altitude correction map and shows what allowances must be made for altitude in different latitudes.

A study of these maps reveals the following features:

The well established cotton fields lie in the minimum cloud zones, *i. e.* generally between 10° and 35° N. and 12° and 35° S. The cotton-belts of the United States, India, etc., almost exactly coincide with the climatic limits outlined on the maps. As regards areas where cotton has been tried and failed, it is indicated that the real cause of failure was due to cloudiness or mists, with the attendant humidity and coolness. Cotton growers should avoid such areas.

These maps indicate that, without increases in present yields per acre, there is enough land with suitable climatic conditions awaiting development to grow sufficient cotton for many generations. The most promiing regions would appear to be the Argentine, Uruguay, Paraguay and S. Brazil. Within the British Empire, assuming that the cloudiness hypothesis is justified, there seems to be good reason for further study of the following areas: Sierra Leone, the Southern Province of Nigeria, almost all the Gold Coast and Togoland, Tanganyika, Nyasaland, Kenya (except the N.W.), and Uganda. The coastal regions of Natal and most of N.E. Rhodesia, S. Ceylon, Malaya, all the British East Indian Islands. The N.E. coastal strip of Queensland. British Honduras, British Guiana, Jamaica and certain smaller West Indian islands. The most promising regions within the Empire for rain-grown cotton, appear to be S. Sudan, N. Nigeria, the valleys of the Limpopo and Zambesi, S. Africa and the 200-mile strip of coast on the east and north of Australia. The most important of these territories border on areas deficient in rainfall, hence their chief problem will be that of sufficiency of rainfall.

The suggestion put forward by the author that cloudiness is a very important factor in cotton production, while limiting the outlook from one point of view, indicates from a study of the subject and the maps that the acreage in suitable climates is probably at least as large again as the present acreage under rainfall cotton.

W. S. G.

[580]

581. **Cotton-Growing in Eritrea.**

CARAVAGLIA, A. C. (Istituto Agricolo Coloniale italiano). Il Cotone in Eritrea. *Bollettino di informazioni economiche del Ministero delle Colonie*, Year XII, No. 1, pp. 56-61. Rome, 1924.

Cotton has been grown in Eritrea for many years, but active work there dates only from 1902. After the first trials, which gave encouraging results, the "Society for Cotton-Growing in Eritrea" was founded, and, basing on results from Egyption varieties grown in favourable soils, in 1904 this Society undertook to place the crop on an industrial footing, but was faced with difficulties which caused failure. An adaptable American variety (Allen's Improved) having been found after some years, the problem seemed to be solved, but, after a yield of 12,000 quintals in 1912, production fell owing to various causes, not all dependent on the programme drawn up by the Society. At present the whole of Eritrea produces less than 2000 quintals of seed cotton, of which about 1000 are produced in the western lowlands and 1000 on the table-land and in Zula.

In Eritrea cotton-growing is possible between sea-level and a height of 1800 metres.

Crops are distinguished as follows: those which utilise the rains alone and which are generally arboreal; herbaceous or annual plants, the growth of which is helped by the muddy waters carried down by the torrents during the season of heavy rains.

The arboreal plants may be profitably cultivated in clay soils receiving the summer rainfall: the varieties, methods of cultivation and yield, vary in the table-lands above 950 metres as compared with the mountain districts. In the table-lands, at the beginning of the rainy season, after having cleared the soil of dry grasses by burning, sowing is done without any previous ploughing, 8 to 10 seeds being placed in open holes in the ground. The cotton plant springs up and grows during the continuation of the rainy season and gives a sufficient yield the first year to cover the expenses of sowing, tillage, etc. In the second year, after the first rains, the shrub grows rapidly, giving a yield similar in quality to that of the first year, but much better as regards quantity. In the third year production falls off greatly and the quality degenerates. In the mountain districts, up to a height of 1800 metres, the natives grow cotton for the first two years in conjunction with other crops, afterwards leaving it to grow alone for another 3 or 4 years.

The herbaceous or annual crops are grown in the lowlands in the east and west. The scarcity of rains in these districts may be compensated for by the, muddy waters of the torrents, such as the Gax and Barca; this muddy water may be utilised: by irrigation; by means of underground reservoirs; by flooding or inundating. The last two methods are preferable owing to the fact that they deposit on the soil the very fertile silt which the torrents bring down. In the flooded soils, sowing should be done after what is considered to be the last flood, and is generally begun in the higher grounds which have benefitted, during the second part of September.

The plant grows, and the pod begins to ripen at the beginning of January and continues until the end of March.

The variety now grown is that known as *Carbacat*, which may be considered to be a local variety produced from the Allen's Improved.

A. C. M.

582. **The Quality of Ratooned Queensland Cotton.**

SUMMERS, F. (British Cotton Industry Research Association). *Journal of the Textile Institute*, Vol. XV, No. 12, pp. 543-546. Manchester, 1924.

The advantages and disadvantages of ratooning are discussed and a comparison is made between a sample of Queensland cotton grown from seed, and a sample grown under the same conditions from plants which had been ratooned at the end of the previous season. In the case investigated, the conclusion drawn is that, the quality of the ratooned cotton is inferior to that of the usual, first-year product.

A decrease of over 6 % was found in the mean staple length of the ratooned sample, and the staple was found to be more uniformly long in the annual. The hair weight per centimetre was significantly less in the ratooned sample, corresponding with the smaller wall thickness, but there was no apparent difference in the degree of convolution of the two samples.

With the exception of a slight increase of strength on mercerisation, the comparison is entirely against the ratooned sample. If further experiments show that ratooning does not give an increased yield, as was the result of experiments made in South Africa, there appears to be little in favour of the practice from an agricultural point of view, and nothing at all from the point of view of plant sanitation.

It is not suggested, however, that ratooning should be condemned without more evidence from other parts of the world, as the above results are true only for the particular Queensland samples under discussion.

W. S. G.

583. **Possibility of Creating a Flax Industry in South Africa.**

BAKER, E. *Journal of the Department of Agriculture, Union of South Africa*, Vol. X, No. 2, pp. 110-125. Pretoria, 1925.

The article is a general review of the position of the flax industry, the author having visited Europe in 1924 to study the question. General items of botanical and of cultural interest are omitted, as these can be found in text books. Certain ideas bearing directly on crop improvements, as also economic methods of factory management are dealt with, as they are of value to the farmer in deciding whether he can make a profit on growing the crop, and if the factory side of the problem can be worked satisfactorily.

Allusion is made to the work of the Linen Research Association in Northern Ireland, in the establishment of pure lines of improved flax.

W. S. G.

584. **Sisal Hemp.**

JACK, R. W., BISHOP, R. O. and MILSUM, J. M. *Malayan Agricultural Journal*, Vol. XII, No. 11, pp. 352-370, plates 2. Kuala Lumpur, 1924.

The object of the article is to draw attention to the industrial possibilities of sisal (*Agave sisalana*, Perrine) in Malaya, as the work of the Department of Agriculture has shown that it can be grown successfully under local conditions. The information in the paper is equally applicable to any tropical or semitropical country suitable for the crop. The authors discuss the plant under the following heads: climate, habitat, botanical, diseases (practically unknown), soils, propagation, planting, harvesting, preparation of fibre, yield of fibre, quality, cost of production, supply, demand and prices, utilisation of sisal refuse. W. S. G.

585. **Henequen Fibre or Mexican Sisal Hemp.**

Bulletin of the Imperial Institute, Vol. XXIII, No. 1, pp. 4-8. London, 1925.

The article gives an account of Agave, the henequen plant, from the time of the first attempt to produce the fibre on a large scale in Yucatan, in 1839, to the present day. The following sections are discussed, in addition to an historical account: the plant and its varieties, climate and soil, cultivation, pests, harvesting, extraction of fibre, cost of production, export, and in an appendix are given factors relative to the total expenses incurred in henequen production. W. S. G.

Tropical and Sub-Tropical Industrial Plants.

586. **Continuous Growth of Java Indigo in Pusa Soil.**

HOWARD, A. (Imperial Economic Botanist) and HOWARD, G. L. C. (Second Imperial Botanist). *The Agricultural Journal of India*, Vol. XIX, Part. 4, pp. 607-612. Calcutta and London, 1924.

Evidence has been brought forward of phosphatic depletion in the soils of North Bihar. Direct field trials with superphosphate gave no definite results.

The authors in 1919 started an experiment in which Java indigo was grown continuously in a lysimeter having an area of one-thousandth of an acre and a soil-depth of 18.5 inches. No phosphate was added at any time, hence, if the limiting factor was depletion of phosphate, the crop would show progressive diminution in yield.

No change in growth of the indigo was observed until 1922, a year of heavy rainfall, when signs of nitrogen starvation became evident. The addition of sulphate of ammonia, and some sugar to assist the nitrogen-fixing bacteria, soon restored the growth and improved the soil texture.

Although the soil had no rest, and no rotation was practised, the yields were higher than many of those obtained on indigo estates.

The results do not indicate that Pusa soil is deficient in phosphate. The only soil deficiency observed in this experiment was loss of permeability, followed closely by want of combined nitrogen. The difficulty of permeability of the soil was somewhat of a surprise as the soil was above the average in porosity and good drainage was provided in the lysimeter. Loss of permeability is a serious factor in the rains and the soil assumes a wet, jelly-like condition, well-known to cultivators, under which conditions the indigo plant reacts rapidly. The loss of permeability is probably due to the formation of colloids and it is possible that the addition of substances such as sulphur, which produce dilute acid on oxidation would prevent the formation of these colloids. Preliminary experiments with sulphur and dilute sulphuric acid increased growth during the rains, and acted on the indigo plants like dressings of nitrogenous manure.

W. S. G.

587. **Studies in Jelutong.**

GREENSTREET, V. R. *The Malayan Agricultural Journal*, Vol. XIII, N. 10, pp. 1-8, tables IX. Kuala Lumpur, 1925.

The production of jelutong in the Malay States has increased from 100 pikuls (1 pikul = 133 lb.) in 1922 to 2000 pikuls in 1923, most of the product going to the United States, where it is used in the manufacture of chewing gun.

Jelutong is regarded as an oxidation product of caoutchouc, and analysis has shown its composition to correspond to $C_{25} H_{40} O$.

The author states that condizions in the Malay States are favourable for the production of jelutong. Various methods of coagulation and refining of jelutong latex are described. The characteristics and defects of jelutong prepared in different ways are discussed under the headings: rate of drying; resinification; development of mould. W. S. G.

588. **A Comparison of the Yields of Beets in Czecho-Slovakia.**

Bericht über die vom Zentralverein der tscheslovakischen Zuckerindustrie im Jahre 1924 veranstalteten vergleichenden Versuche mit Zuckerrübensamen (Berichte des Forschungs Institutes der csl. Zuckerindustrie). *Zeitschrift für die Zuckerindustrie der cechoslovakischen Republik*, Year XLIX, No. 24, pp. 179-183. Prague, 1925.

The new varieties examined may be classified as follows.

Sugar Content Percentage: I) Zapotil I (19.40), Dippe WI (19.38), Dobrovice (19.36), Mandelik (19.36), Dobrovice (19.24) — II) Zapotil (19.13) — III) Kleinwanzleben (18.92), Schreiber SS (18.92).

Weight of yield — kg per hectare: I) Kleinwanzleben (368.6), Zapotil II (367.9), Dobrovice (363.6) Hörning (363.2). — Schreiber SS (361.8), Zapotil I (359.6). — II) — Dippe (354.6). — III) Mandelik (338.5).

Sugar production — kg per hectare: I) Dobrovice (70.0), Zapotil II (70.0), Zapotil I (69.9), Dippe (68.8), Schreiber (68.5), Hörning (68.1) — II) Mandelik (65.7). A. F.

589. **Tea Nurseries.**

COOPER, H. R. *Journal of the Indian Tea Association*, Part. III, pp. 150-167, figs. 4. Calcutta, 1924.

In planting out a tea garden the important consideration is the production of healthy young plants, for which a good nursery is essential. The author's notes on nursery planning are based upon personal experience.

Moisture : The most important factor is moisture, and rain is better than watering by hand, as the latter method does not produce a moist atmosphere.

Shade : A moist soil and moist atmosphre are both maintained by shade, which may be satisfactorily produced by a very thin thatch, supported by a frame-work at a height of 5 feet or more from the ground. Such a shade often renders watering unnecessary, except just after planting. The shade should be retained for the whole of the year, the thatch being gradually removed.

Soil Factors : A good sandy loam is best, but seedlings will grow on a clay soil if the texture is good.

Manuring : An application of potash is generally of value, but of more importance is the physical condition of the soil. Texture is improved by cattle manure, but the drawback to this is that it carries so many weed seeds. A green crop may serve the same purpose as cattle manure, if hoed in at least two months before sowing the seed. As a source of nitrogen liquid manure is excellent, but is troublesome to apply ; a dressing of 2 cwt. of nitrate of soda per acre gives very good results if applied when the plants are about 4 in. high.

Burning : The soil is greatly improved temporarily, by heat; the greatest effect is obtained by heating just before sowing, and the best method is to spread rubbish on the surface of the soil and burn it *in situ*, as the soil benefits both by the heat and the ash. Heating the soil by means of boiling water alone has given good results.

Preparation of Land : The depth to which it is advisable to dig the land varies with the soil, but the author has obtained the best results by working to a depth of 9 to 10 inches. All kinds of jungle growth, grasses and weeds must be carefully removed from nursery soil.

Drainage : The usual practice is to make up nursery beds about 6 feet wide, with ditches 1 foot in width between, which serve as paths between the beds.

Planting Distance : At Borbhetta (Assam) good results are obtained by triangular planting at a spacing of 8×8 inches, but the age at which seedlings are to be transferred must be taken into account ; the above spacing is for 12 months plants ; for 24 months plants 10×10 inches is recommended.

Germination : On the outside of the hard shell of the seed is a scar, usually called the " eye " ; seed should be planted with the eye down, as the young plant will then be in the correct position for growth and the root will not have to bend round the seed.

Depth of planting : Seed must not be planted to deeply ; half an inch

of soil should be fine and loose. Immediately after planting, the soil should be well soaked with water, after which, if well shaded, very little more water will be needed. It is essential that tea seed should be fresh.

Cultivation : The first weeding should be done by hand ; afterwards, a Planet Junior Two-wheel Hand-cultivator may be used. On this hoe the wheels are connected by a hoop which goes over the line of young plants. W. S. G.

590. **Cultivation of the Tea Plant at Tranninh (Haut-Laos).**

DU PASQUIER, R. Le théier et sa culture au Tranninh. *Bulletin économique de l'Indochine*, Year XXVIII, No. 169, pp. 605-619, separate maps and plates. Hanoi, 1924.

The author, tea and coffee specialist at the Agricultural Station at Phu-tho, Tonkin, was entrusted with the work of studying wild tea-plants and the possibilities of growing tea at Tranninh (Haut-Laos, French Indo-China). The present note constitutes his report on this work.

Tea plantations were formerly more numerous and important than they are to-day in this high region. The natives, by excessive exploitation, must have caused the disappearance of several plantations and have, in any case, greatly reduced the number of plants of which they are composed. The only tea-plants still existing in the regions inhabited by the Laotians are those of Muongthane ; the others are scattered in small plantations in the mountain groups which were, before the immigration of the Meos (1), covered with virgin forest and uninhabited. They are therefore quite wild and not, as is the case with the tea-plants in the forestsof Central Tonkin, sprung from ancient plantations belonging to villages which have disappeared.

The species of tea-plant at Tranninh, as M. MIÉVILLE observes (2) belong to two groups of different forms: those of the North Eastern plantations (especially of the Phou-sang plantations) belonging to the group of the 5th Military Post (Laos) and Y-pang (Yunnan) ; and those of the plantations of the South and East, to the group of North Annamand Middle Tonkin.

The result of this investigation is that Tranninh is suitable, from its climate and soil, for tea crops, but that these can only prosper when the conditions for obtaining labour and the transport of goods have improved.

(1) The "Meos" or "Miaos" emigrated from China into Haut-Laos as late as the middle of the XIX century, after the frightful massacres by the Chinese about this time at Kuicheu, where the Meos formed the greater part of the population. They are mountaineers living in lofty mountains : they follow the disastrous "ray" systems (the burning of forest and brush) in cultivation. They are good livestock breeders and it is they who grow opium at Tranninh. — (Note from the Correspondence Bureau of Indo-China).

(2) R. MIÉVILLE. "Le théier sauvage du Phousang", in the *Bulletin agricole de l'Institut Scientifique de Saïgon*, Year II, 1920, summarised in the *Bulletin des Renseignements agricoles des Plantes*, June 1920, No. 648.

At present this province seems more adapted for such crops as that of the camphor-tree or plants for distilling perfumes, which can be mechancally cultivated and yield products of great value and small volume.

It would be preferable therefore first to consider the formation of tea plantations in other parts of the Annamite chain, also situated at a height of between 1-2000 metres, but nearer the coast, which alone can furnish labour, and having better means of communication with the ports.

While waiting until Tranninh can in its turn become a centre of tea production, the natives might at once be initiated into this cultivation. Attempts had already been made by M. BARTHELEMY, Government Commissioner, and M. MIÉVILLE; but the Laotians allowed the young plants which had been distributed among them to perish. The only way of obtaining results would be to commission the school teachers, in conjunction with their pupils, to establish and cultivate small plantations of about 100 plants. They could also plant some shrubs in the neighbouring villages and superintend their growth.

The younger generation would thus be capable later of furnishing experienced foremen and workmen.

These small plantations would also form a system of experiment grounds which would enable the fertility of the soils to be estimated.

The only species which should be grown is the Phou-sang. This species might be grown not only in Tranninh, but also in the plantations of Annan and Tonkino, where it should replace inferior species.

Unfortunately the Agricultural Station at Tranninh, so far only produces a sufficient quantity of seed to sow barely 3-4 ha. per year. The seed of the best types of tea at this Station should therefore be utilised first, in establishing large seed nurseries. These may become an important source of revenue for the Province. The true future of the tea crop in Tranninh lies probably in this direction, and not in that of tea production. The upkeep and exploitation of a nursery only require a few coolies, and the value of the seed will certainly be higher than that of tea. The proprietors of reproduction nurseries might easily find them profitable, both in Indo-China where the tea industry is developing more and more, and in Ceylon and Java. These two Colonies, not being able themselves to produce the quantities of seed they require, are obliged to import it every year from Assam at a heavy cost and at the risk of introducing the "Blister Blight" disease. Corr. Indo-China.

591. **The Chemical Analysis of Tea with regard to Quality.**

DEUSS, Dr. J. J. R. (Chemist, Experiment Station for Tea, Buitenzorg). *L'Agronomie Coloniale*, Year II, No. 80, pp. 41-47. Paris, 1924.

The quality of tea is determined by its appearance, the aroma, the infusion resulting from the placing of 3 gm. of tea in 150 cc. of boiling water for five minutes, and the colour of the leaves after infusion.

Chemical analysis has not yet supplied data of value in judging quality. It is importantto know the moisture-content before packing, which should

[591]

not exceed 6 %. The content of caffein, tannin and other substances is of little value in respect to quality, and cannot be used for classification of teas.

Experiments have shown that the caffein-content of fresh tea does not change during manufacture by mechanical methods. Oxidation may reduce the tannin content, or the tannin may become insoluble from too high temperatures during the withering and drying processes. Excessive fermentation reduces tannin-content.

The author gives a summary of the analytical methods followed in his laboratory, and the results obtained from different teas.

Type of Tea	Caffein %
Java teas from different estates	2.7 to 4.4
Japan green teas of different qualities	2.0 » 3.3
China tea (black) from Amoy	2.0
Tai Pin black tea	3.0 » 3.7
Tonkin Green tea, pressed cubes	1.5
Indo-China Flower tea	1.5
Man-Hao tea	3.0
Tonkin tea for export	3.1
Indo-China teas, various	3.2 » 4.1
Formosa-Oolong tea	3.1 » 3.7
Burma tea, buried and prepared by Burmese method	trace
Guatemala tea	3.5

From the data given it is seen that there is no relation between caffein-content and quality of tea, and the same is true of the ash content, which is of use only in investigations respecting adulteration.

A more important factor is the amount of matter soluble in hot water; analysis of different teas gave a maximum of 26 % for Java teas, 22 % for China, 14.7 % for Tonkin tea for export, and only 2.7 % in the case of Flower tea. However, these figures do not indicate quality, which is the case also as regards the tannin content, although the best teas contain a higher percentage of tannin than those of lower quality. It is very important to have fresh tea for determination of tannin content, as in old or mouldy tea much less is found.

No one has attempted to produce better teas by the reduction of the caffein or tannin content.

The author concludes that it is not possible to establish a relation between the percentage of any of the above substances and the quality of tea. As is the case with different vintages of wine, so it is with tea; the good grades are the result of scientific cultivation and manufacture, and the environmental conditions under which they are grown.

W. S. G.

592. **N cotine and Ash Constituents of the Leaf of Tobacco Plants.**

CUTLER, J. V. (School of Agriculture, Potchefstroom). *The South African Journal of Science*, Vol. XXI, pp. 208-222, tables 6, figs. 3. Cape Town, 1924.

Tobacco leaf from a fertiliser experiment carried out at the Rustenburg Tobacco and Cotton Experiment Station, was examined to ascertain the effect of various fertilisers upon the leaf and the ash ; the effect of the fertilisers upon the growth of the plant and the size and grade of leaf was also studied.

Light dressings of lime increased yield per acre, area of leaf and percentage of midrib. Potash alone, gave an increase, but combined with lime grave a decreased yield. Nitrogen produced an increase in total yield, but decreased the percentage of the lighter grades of leaf ; midrib was decreased ; leaf area was not materially increased. Phosphates gave an increase over all single fertilisers and increased the percentage of midrib, Nitrogen with potash, and nitrogen with phosphate gave increased yields. but at the expense of the lighter grades of leaf. Nitrogen and phosphate increased the percentage of the lighter grades. Complete fertilizer and farm manure gave the maximum return per acre. Nitrogen gave more luxuriant growth with a lowering of quality.

With reference to the ash constituents, the author found that the use of fertilizers had not increased the percentage of mineral constituents, except that potash with lime gave a slight increase.

The ash content of the yellow, red and dark grades of leaf was compared. In the lighter grades there is a slight increase of potash, sulphate and iron, and a corresponding increase of lime and silica. The nicotine content was lowest in yellow leaf and highest in dark red. Application of nitrogen caused a marked increase in nicotine.

Examination of the leaf with various solvents indicates that the nicotine is in combination with the calcium present ; where the calcium is in greater quantity the nicotine is not readily soluble in ether, but dissolves more easily in alcohol. W. S. G.

593. **Essential Oils from Various Parts of the British Empire.**

Bulletin of the Imperial Institute, Vol. XXII, No. 3, pp. 303-333, plates 3. London, 1924.

The article contains an account of the results of examination at the Imperial Institute, London, of essential oils received from various parts of the Empire. In each case are given : a description of the material as received, chemical analysis, characteristics, industrial prospects. The following products yielding essential oils are discussed : Vetiver roots, from the Gold Coast and from the Federated Malay States ; Inchi grass (*Cymbopogon coesius*, Stapf) from India ; Tsauri grass, (*Cymbopogon giganteum*) from Nigeria ; Patchouli oil from Seychelles ; Cinnamon oil from Seychelles ; Thyme oil from Cyprus ; leaves of *Ocimum gratissimum* from South Africa ; Huon pine from Tasmania ; *Tagetes minuta* oil from South Africa. W. S. G.

Arboriculture.

594. **Orchard Practices in the Citrus Industry of Southern California.**

VAILE R. S. *University of California, Agricultural Experiment Station Bulletin*, No. 374, pp. 50, tables 27. Berkeley, Cal., 1924.

The purpose of the Bulletin is to show from actual fields records the influence of fertilisation, ploughing, climate, soil, age of trees, and costs, on the profitableness of citrus orchards.

The following conclusions are drawn from data collected from about 600 citrus groves, only records being used for analysis that covered a working period of five years.

Citrus groves (in California) produce more fruit per acre near the coast than in the interior, but they do not return higher net profits.

Soils of a medium texture are mainly used, as very sandy soils or clays are less productive.

Citrus trees usually increase in average yield until at least 35 years of age.

Nitrogen and bulky organic manures give the best results. Exclusive applications of nitrogen seem to cause mottling.

Orchards with winter cover-crops gave higher yields than clean-cultivated orchards.

Less irrigation water should be used near the coast than in the interior.

W. S. G.

595. **The Banana and its Cultivation.**

Bulletin of the Imperial Institute, Vol. XXII, No. 3, pp. 303-335, plates, 3. London, 1924.

In the article a botanical description of the banana is given, and the plant is then discussed under the following headings: climate and soil, propagation, cultivation, pruning or suckering, harvesting, after-cultivation, packing and transport, diseases, pests, subsidiary products, banana cultivation in various parts of the British Empire.

Two species of banana are grown commercially, a variety of *Musa sapientum*, in Central America and Jamaica, and *M. Cavendishii* or *M. Sinensis*, a native of Southern China, a smaller fruit than the former, is largely grown in the Canary Islands.

It is suggested that the West African colonies and other tropical areas, might with advantage cultivate this crop, especially those within a comparatively short distance of the chief European markets.

W. S. G.

596. **Almond Varieties in the United States.**

WOOD, M. N. *United States Department of Agriculture Bulletin No.* 1282, pp. 140, plates 26. Washington, D. C., 1924.

The author gives a description of 151 varieties of almonds grown in the United States, both the more important and those less well known.

A key is supplied to almond varieties, based upon the characteristics of the nut.

The 26 plates are very instructive, and in the index of varieties the reader is enabled to see at a glance the important varieties and those which are not well known or are not grown commercially. W. S. G.

597. **Walnut Culture in California.**

BATCHELOR, L. D. *University of California, Agricultural Experiment Station Bulletin No.* 479, pp. 91, figs. 34, tables 7. Berkeley, 1924.

The Bulletin represents the results of general observations and specific investigations of the author and his associates. The industry is discussed under the following heads: Climatic requirements, soil, water supply, varieties, rootstocks, starting the orchard, culture, diseases and pests, harvesting, curing, packing and cost of production.

The walnut tree bears profitable crops when from 6 to 10 years old, according to variety and environment and the average yield is about 800 lb. per acre; groves which have averaged 1500 lb. for a period of ten years are rare. W. S. G.

Forestry.

598. **Forestry and Agriculture.**

MARSHALL, R. C. (Conservator of Forests, Trinidad and Tobago), *Tropical Agriculture*, Vol. II, No. 4, pp. 70-72. Trinidad, 1925.

Forestry and agriculture are both based on the yield-capacity of the soil; trees are often far less exacting in their soil requirements than are agricultural crops, and can be successfully grown on areas which are quite unsuitable for agriculture.

The indirect utility of forests. The opinion is widely held that forests increase rainfall to a marked extent: EBERMAYER started observations in Bavaria in 1867, but came to the conclusion that in the plains the effect of forests is very small, but increases with elevation. Extensive observations made in Sweden at 400 stations over a period of 15 years showed that land with 56 % under forest certainly did not receive more than 3 % rainfall in excess of land with 17 % under forest. The Government of India has studied the subject and concludes that, if forests influence rainfall at all the effect is insignificant.

Forests, however, have a profound effect on the conservation of water. The trees lessen the force of heavy, tropical rainfall; the surface soil in a forest consists of decaying organic matter capable of absorbing large quantities of water, which is held and eventually passes out as springs which yield a steady supply to streams and rivers. A tropical rainfall on a bare hill-side is not absorbed and causes erosion of the soil and floods in the valleys.

The direct utility of forests. Forests, in addition to timber, produce many important secondary products. In countries where forests have

reached the protection stage, yield tables are available from which the average annual return per acre can be calculated. From the standard formula, under a given set of conditions, the return per acre works out at 18s. and unless this return can be obtained by agriculture it is preferable to grow timber on that area.

Every acre of land round head-waters and along the banks of rivers on which forest cover would protect against erosion and soil wastage, should be forested. All forested lands should be so managed as to yield a maximum of the products most needed by the local communities and industries.

Without agricultural development the present state of civilization cannot be maintained. We had better be without gold that without timber.

W. S. G.

599. Regeneration of Forest Species with the Assistance of " Taungya" in Burma.

BLANFORD, H. R. (Conservator of Forests, Burma). *Indian Forest Records*, Vol. XI, part 3, pp. 39, plates 10. Calcutta, 1925.

The object of the article is to summarise recent work in forest regeneration with the assistance of the *taungya* method. The word *taungya* is the Burmese name for temporary cultivation on hill land, and is similar to the German system of " Waldfeldbau " or cultivation of forest with crops.

The method may be briefly described as follows : All marketable timber is extracted, after which, in the forests of Burma there remains a bamboo undergrowth and worthless trees, which are felled by the *taungya* cutter and burnt on the land. During the rains rice or other cereals are sown, and the sowing or planting of tree species is carried out at the same time. The tree seedlings are tended by the *taungya* cutter as long as the field crop is on the ground, after which the land is taken over by the Forest Department.

The great advantage of this method of forest regeneration is that it combines the production of a food crop with the forest crop, and so makes possible the establishment of the necessary labour force, often one of the most difficult problems in forest work.

The author outlines a typical case of regeneration on the above system and gives instances where regeneration has been adapted to local customs.

W. S. G.

600. Reafforestation with Cedar (*Juniperus Procera*) of the Shume Forest Reserve, Tanganyika Territory.

MABER, E. D. *Quarterly Journal of Forestry*, Vol. XIX, No. 1, pp. 6-12. London, 1925.

The Shume Cedar Forest is a matured virgin forest situated in the N.W. of the Usambara Mountains at an altitude of 5000 to 7000 feet, and has an extent of about 20,000 acres. There is a stand of 15 to 20 cedar trees per acre, which would yield about 1000 cubic feet of timber.

During the past 3 ½ years the Forest Department has been reafforesting with cedar in the Shume and neighbouring forests. Nurseries have been established; 2000 seedlings from 1lb. of seed is a good average, although more than double that number have been obtained.

Plantations have been made both in open ground, and under shelter wood; in dry situations the open ground was not successful.

The approximate cost per acre to the end of the second year, of a shelterwood plantation with seedlings planted 4 × 4 feet, is given as £6-8-6. Undergrowth is rapid and five cleanings are necessary in two years in a shelterwood plantation and six or more on an open plantation.

W. S. G.

601. **The Growing of Poles for Electric-Transmission.**

GOUDIE, H. A. (Conservator of Forests, Rotorva, N. Z.). *New Zealand Journal of Agriculture*, Vol. XXIX, No. 4, pp. 243-253, figs 3. Wellington, 1924.

In writing the article the author had in mind the great development which is taking place in the production and use of electricity, and the very large demand likely to exist in the future for poles for extension of power lines and renewals. It is estimated that for renewals alone, in addition to telegraph and telephone pole requirements, 40 000 poles per annum will be necessary.

The main qualifications required of a pole are strength and durability, hence only poles of the highest quality are employed. For this purpose Australian ironbark poles are used of the following species: Grey or white ironbark (*Eucalyptus paniculata*), broadleaved ironbark (*E. siderophloia*), narrow-leaved ironbark (*E. crebra*), and red ironbark (*E. sideroxylon*). Although the main object of the article is to deal with the growing of trees for pole-production, the author describes species and varieties recommended for farm forestry. Attention is drawn to the advantages of planting the waste places on a farm with trees, which in most cases may just as well be valuable, timber-yielding species, as trees which have a shelter value only.

W. S. G.

602. **Coolibah Timber of Western Australia.**

Bulletin of the Imperial Institute, Vol. XXII, No. 3, pp. 280-284. London, 1924.

The properties of coolibah timber were investigated by the Imperial Institute, London. Coolibah (*Eucalyptus microtheca*, F. v. M.) is found in the drier parts of Australia, except Victoria; it is estimated that in Western Australia 20,000 tons are available.

The wood is extremely hard, tough and heavy, and has been used for machinery bearings, cog-wheels and tail-shafts bearings. The height of the tree is from 70 to 80 feet, with a diameter of about 4 feet. Average weight per cubic foot, 89.5 lb.; colour dark brown; resistance to crushing

and shearing exceptionally high. The wood is very difficult to work, and blunts the teeth of power-saws; nails bend and the wood tends to split; good results are obtained by turning. Careful seasoning is essential.

W. S. G.

603. **Balsa Wood from British Honduras.**

Bulletin of the Imperial Institute, Vol. XXIII, No. 1, pp. 17-32. London, 1925.

"Balsa" is the local name of a very light wood found in parts of tropical America. The wood is suitable for the manufacture of life-belts, fenders for life-boats, and as a cork substitute for bottle stoppers.

Investigation showed that the weight per cubic foot varied widely according to its distance from the centre of the log. The inner wood weighed about 7.5 lb. per cubic foot, when dry, and the outer wood 21.5 lb. per cubic foot. These wide differences in weight may possibly be related to the rapidity of growth of the tree.

The particular variety investigated is known locally as "Polak" (*Ochroma Lagopus*).

W. S. G.

604. **Burma Oak and Chestnut Tans.**

PILGRIM, J. A. (Forest Research Institute, Dehra Dun). *Indian Forest Records*, Vol. X, Part XI, pp. 90, tables IX. Calcutta, 1924.

Part XI of the *Indian Forest Records* forms a report of an investigation from the tannin standpoint of the different parts of various oak and chestnut trees, principally those species growing in the Maymo and Kalaw areas. The oaks of Burma are compared with those of Europe, special reference being made to dyes. The chestnuts of Burma are compared with the Indian *Castanopsis tribuloides*. A list is given of oak and chestnut products which on analysis were not found to be useful.

W. S. G.

LIVE STOCK AND STOCK BREEDING.

General.

605. **Additional Information on the Relations between the Internal Secretary Glands and Immunity.**

MELNIK M. (Pasteur Institute). Contribution à l'étude des relations entre les glands à sécrétion interne et l'immunité. Le corps thyroïde et le Bacille de Shiga. *Comptes rendus des Séances de la Société de Biologie et de ses filiales*, Vol. XCII, No. 7, pp. 474-475. Paris, 1925.

The fundamental principle by which the author has been guided in his investigations is the following: The hormones penetrating by means of the circulation into the organism and bathing all the cells and tissues,

necessarily come into contact, in an infected organism, with the micro-organisms and their secretions ; on the other hand the glands with internal secretion inevitably undergo functional and biochemical modifications under the influence of the microbic activity.

The author has studied the thyroid body in connection with the Shiga Bacillus, which causes dysenteric infection.

He utilised 14 rabbits weighing on an average 2 kg., and of varying age and sex ; 9 of the animals were thyroidectomised and 5 served as checks. 5 days after the operation 2 cc. of a broth culture of the Shiga Bacillus, aged 24 hours, was injected under the skin, both of the animals operated and of the checks.

Of the 9 operated, 4 survived ; of the 5 checks, 4 succumbed after 3 days and 1 after 4 days.

On the second or third day after infection all 14 animals showed clear signs of slight palsy, greatly varying in intensity and duration. The extirpation of the thyroid gland in rabbits therefore seems to favour their resistence to dysenteric infection. P. D.

606. **The Elastic Mucous Tissue of the Cock's Comb and its Reaction on the Sexual Hormone.**

CHAMPY, C. H. and KRITCH, V. Le tissu muco-élastique de la crête du coq, réactif de l'hormone sexuelle. *Comptes rendus des Séances de la Société de Biologie et de ses filiales*, Vol. XCII, No. 9, pp. 683-685. Paris, 1925.

The cock's comb is a complex structure ; it includes a fibrous conjunctive axis, with a little adipose tissue in the middle, the quantity of which varies with the condition of fatness of the bird. This axis contains the large vessels and principal nerves. On either side of it there is a wide strip of special elastic-mucous tissue ; then comes a dense fibrous layer enclosing distended and very close layers, and finally a thick epithelium with a horny layer having numerous cells.

The elastic-mucous tissue is formed of star-shaped cells of which the cytoplasm, full of large cavities, is reduced to a plexus or network. This tissue appears to react against the sexual hormone : indeed, it disappears completely in the castrated bird, whereas the other parts of the comb undergo only slight transformations.

The following are some data on the development of the elastic-mucous tissue : in the embryo there is an epithelial comb under which is adense mesenchymatous tissue with nothing else of a specific nature except vascular traces. In the young cockerel, up to 70 gms., the comb is of similar structure to that of the capon, without a special tissue. The latter appears in a cockerel of 170 gms., beginning at the base and continuing towards the tip. It is well developed all along the top in a cockerel of 300 gms. and seems from that stage to show a parallel growth with the other parts of the comb.

Castration immediately affects it : after 13 days it undergoes a well defined retrogression, commencing at the tip and continuing in exactly inverse order to its progression in the cockerel.

[606]

In the young hen the tissue is absent until the bird lays; the comb is then similar in structure to that of the capon.

This tissue is not peculiar to the Gallinaceous order and is found in other species, with rather different characters, and in different organs.

The elastic-mucous tissue reacts in connection with the hormone and is a particularly sensitive zone, the sensitiveness of which is only revealed by the action of this hormone itself.

What is altogether characteristic is its equal sensitiveness to the genital glands of either sex. This seems to indicate that in the male the influence of the genital gland is permanent, begins early and continues regularly in spite of the important changes in the genital gland during the period of maturity.

In the female, this tissue only appears at maturity and periodically during the laying periods. P. D.

607. **Vine Shoots as a Cattle Feed.**

GIULIANI R. (R. Istituto superiore agrario in Portici). I sarmenti di vite nell'alimentazione del bestiame. *Rivista di Zootecnia*, Year 1, No. 11, pp. 343-346. Portici, 1924.

In view of the high prices for fodder and concentrated feeds, the author examines the possibilities of utilising vine shoots as a cattle feed.

According to SPIRA and MENOZZI's analyses, their chemical composition, which varies with the degree of lignification, the species and variety of vine and the nature of the soil, may be estimated as follows:

Chemical Analysis of Vine Shoots.

	Fresch	Dry
	%	%
Water	38.22 %	12.00 %
Nitrogenous substances	2.28	4.40
Crude fat	1.53	1.70
Non-nitrogenous extract.	30.73	50.00
Cellulose	24.80	27.00
Mineral substances	5.56	4.10

As regards the digestibility of shoots, the greater or lesser degree of lignification, mode of preparation and distribution must be taken into account; but to form an estimate of their actual nutritive properties, it must be borne in mind that owing to their ligneous nature, a large consumption of energy is required for their mastication and digestion; also they are but little appreciated by livestock, so that in their natural state they hardly constitute a product from which the animals derive much benefit.

Crushing the shoots transforms them into a more appetising product and one which may be added to mixed feeds, increases their digestibility,

and considerably reduces the work of mastication and digestion, i. e. increases their nutritive value.

The most economical types of crushers are those with a high-power motor which reduce the shoots to a fibrous mass like hay; other apparatus reduce the shoots into a coarse flour.

The nutritive value of the shoots has been proved by scientific and practical tests.

Prof. TUCCI tested this product on cattle at the Palermo Stock Breeding Institute and came to the conclusion that 150 kg. of shoots replace 100 kg. of hay or 200 kg. of straw; the animals keep in good condition and milk production is not decreased.

Eight kg. of crushed vine shoots, 3 kg. of hay and 3 kg. of oats were substituted for a ration of 9 kg. of straw, 9 kg. of hay and 2 kg. of oats, and this enabled the draught horses given the new feed to keep in good condition.

Prof. VASSILLIÈRE made a test on 10 oxen, 1 cow, 1 mare, 1 ass 1 sheep and 9 ewes. The ration per 100 kg. of live weight was: crushed shoots 17 kg., oat straw 11 kg., decorticated ground-nut cake 2.8 kg., oats 2.250 kg. and salt 0.100 kg. Straw and vine shoots were mixed in bins made of brick and lined with cement, and salt water was poured over the whole; the cake and oats were added to the ration at the time it was fed (thrice daily). An interval of 40 to 48 hours elapsed between the preparation and administration of the mixture, which allowed the temperature to rise to 50-55° C. and thus causing the shoots to become softened.

Good results are obtained by mixing the crushed shoots with molasses in the proportion of 17-18 kg. of molasses per 100 kg. of shoots. The animals freely took the shoots thus treated, and 3.4 kg. per 100 of live weight may be conveniently fed.

The author concludes that vine shoots, properly crushed, may be utilised with advantage for feeding cattle, sheep and pigs.

The shoots should be fed mixed with chopped straw or hay, in the form of a mash with salt water, after the mixture has been allowed to ferment for 48 hours. Concentrated feeds are added at the time of feeding.

The shoots may also be crushed and preserved in silos for subsequent use. P. D.

Special.

608. **Classification of European Breeds of Cattle.**

MURATTI M. (Ispettore zootecnico della provincia di Udine). La classificazione delle razze bovine. *Rivista di zootecnia*, Year II, No. 2, pp. 1-14, 7 figs. Portici, 1925.

The breeds of cattle are the result of the simultaneous influence of climate, soil and human intervention; climate has a preponderating influence, and, climatic conditions being the same, the differentiation of

breeds is determined by the nature of the soil and agricultural conditions. In addition to natural conditions, the exercise of the functions, methods of reproduction and improvements in cultivation may have a very strong influence on the animals.

Classification should be based on economic qualities and serve as a guide in the application of methods of reproduction.

Certain qualities (utilisation of a certain function) are generally common to all breeds, and a particular charateristic is only met with in exceptional cases.

Climate greatly modifies the organic constitution and characteristics, as well as the nature of the products obtained.

The fact should not be lost sight of that between the factors of agricultural production and breeding production, there exists so close a relation that the value of cattle breeds cannot be properly estimated without a profound and exact knowledge of the agricultural features of the various breeding districts. It is useful to remember the relation existing between the development of characteristics on the one hand, and on the other the physiology of nutrition and the faculty possessed by animals of different breeds to produce, with the same nutritive principles, different products according to their specialisation.

Basing on these principles the author proposes to class the most important European cattle breeds into three large groups:

A) Breeds specially bred for a single characteristic (breeds for one object), e. g., meat production;

B) Breeds raised for two objects (meat and milk or meat and work) these two characteristics being equivalent, or one predominating over the other;

C) Breeds for three objects (milk, meat and work) with the most varied combinations of the three characteristics.

A. — *Single purpose breeds* (*meat production*). These exist only in England: Shorthorn meat producers, Hereford, Devon, Aberdeen-Angus. They are very early maturing, or heavily developed, and have a marked tendancy to fatten. The general appearance of the animals at the first glance reveals their specific characteristic: a compact body, well balanced, wide, supported by short, light limbs. The average weight of the adults is about 900 kg. for bulls and oxen, 600-800 for cows. The yield in butcher's meat varies from 69 to 70 % with 10 to 16 % of fat.

B. — *Dual purpose breeds* (*milk and meat or milk and work*).

(1) *Northern breeds* (*milk and meat*).

(*a*) Breeds in which the milk-producing character is predominant, of large size: Frisian, British-Holstein, Dairy-Shorthorn. These breeds have great mammary development; trunk wider at the croup, narrower at the thorax, wedge shaped; exaggeration of the female secondary sexual characters; fairly early maturing, high milk yield and low meat yield.

(*b*) Small breeds in which the milk-producing character is predominant: Ayrshire, Jersey, Guernsey, Kerry, Brittany. The same characteristics as (*a*).

(*c*) Small breeds belonging to high mountain districts, with predominant milk production: Herens, Valdostana. Very hardy.

(*d*) Breeds possessing the two characters (milk and meat) in an equal degree: Normandy, with high meat and milk production, net yield in butcher's meat: 52-56 % for oxen, 45-50 % for cows. Milk yield over 3000 litres with 4-5 % of fat.

All these breeds (B) (1) are of delicate constitution and show slight resistence to climates different from that of their native country, and the stronger their individual qualities, the more marked is this characteristic.

(2) *Central and Southern breeds (meat and work).*

(*a*) Breeds with predominant meat production: Charollaise and Limousine: large, long trunk, without bony protuberances, strong bone structure. Live weight of adults: oxen 700-1000 kg., cows 500-800 kg. Net yield of butcher's meat, 50-60 % with 5-10 % of fat.

(*b*) Breeds for draught purposes: Maremmane, Apulian.

(*c*) Breeds for draught purposes and high yield in butcher's meat: Romagnole, Chianina, Marchesan.

The characteristics of the breeds comprises under the headings (B) (2) and (*c*) are: strong skeleton, powerful muscular masses, large deep trunk, firm, well-set joints, large, compact, horny hoofs, high quarters, greater developmnt of the fore quarters than of the hind quarters. These characteristics vary somewhat according to breed, degree of improvement and surrounding conditions. The live weight and net yield likewise vary.

In all the breeds comprised under (B) (2) resistance, strength, hardiness and lack of fineness are in direct proportion with the development of the aptitude for work, and in inverse ratio to that of the aptitude for milk production.

C. — *Breeds for 3 purposes (milk, meat and work).*

(1) *Breeds belonging to the Northern slopes of the Alps.*

(*a*) Breeds in which milk production predominates over that of meat: brown Swiss race; dappled Swiss races (Simmenthal, pied-black and pied-red Friburg).

(*b*) Breeds equal in milk and meat production: Moelthal (pied-red of the Austrian Alps).

The average annual yield of cows is about 6-7 times their live weight, according to the degree of improvement (animals weighing 300 kg. giving 1400-2400 l. of milk, those of 500 kg. 2500-4000 l.).

Meat production is in direct proportion to the degree of perfection attained by the different races, being from 45-50 up to 55-60 % of the live weight.

Work production is not high as a rule, the cows being bred for milk production only, and the oxen used for work. The Moelthal race is most suitable for draught purposes.

(2) *Breeds belonging to the South slopes of the Alps and the plain (great endurance for draught work).*

(*a*) Preponderating development of the aptitude for work com-

bined with moderate milk production : grey Venetian race, Piedmont plain, Modenese and Reggian ; long trunk, greater devlopment of fore quarters than of hind quarters owing to the absence of scientific improvement methods. Moderate earliness in maturing, very large size.

The chief aptitude is for work ; meat production varies according to race and the age, sex and degree of fattening attained by the animals of each breed. Net yield varies from 45-50 to 50-55 and even 55-60 % of the live weight.

The milk depends on the quantity of work required of the animals, feeding and selection. The average live weight of the mountain breeds varies from 300 to 400 kg. and of the plain breeds, cows 400-600 kg. and oxen 500-800 kg.

As regards the breeds comprised under the heading (C), their physical characteristics depend on the one hand on the development of the aptitude for work, and on the other on the development of meat and milk production.

The greater the endurance of the breeds at work, the hardier and coarser are they; the greater their aptitude for milk production, the more delicate do they become.

When the races are properly classified according to the climate and agricultural conditions of the different countries in which they are bred, selection and methods of reproduction may be applied. A more detailed examination of the races of a given country can then be made in order to determine whether, and in what degree, selection, crossing or substitution should be applied. P. D.

609. **Feeding Calves on Milk, Supplementary Feeds and Milk Substitutes.**

SCHMID, A. and LANODIS J. (Agronomic Eng. E. T. H.) Die Ernährung der Kälber mit Milch und mit Ergänzungs- und sogenannten Ersatzmitteln. *Separatabdruck aus dem Landwirtschaftlichen Jahrbuch der Schweiz*, 1925. Zentralverwaltung der Schweizerischen Landwirtschaftlichen Versuchs- und Untersuchungsanstalten, Liebefeld-Bern, pp. 62, figs. 7. Berne, 1925.

In the 1st part of the *Annuaire agricole de la Suisse*, of 1925, German edition, a work has appeared under this title which is of special interest to Swiss cattle breeders. The authors proposed to ascertain practically the feeding value of the principal feeds used for rearing calves, basing on tests already made. They begin by showing the influence of feeds on calf-rearing in general, statinetg the mhods to be recommended in the rearing of the Simmenthal breed, and the present ideas on the value of supplementary feeds and milk substitutes.

This is followed by a table of the results of the most conclusive experiments hitherto published, the data of which come exclusively from disinterested Experimental Stations (official research establishments especially of Switzerland).

In the third chapter the authors give the results of experiments made at Liebefeld on rearing Simmenthal heifers. Te result of these ex-

periments is that on the whole, calves raised on whole milk, i. e. which have received an abundance of milk (800-1000 litres per head for the rearing period), as is the custom in Switzerland, and a supplementary ration of the usual unmixed feeds and hay, are superior to those reared on milk substitutes. They are superior in actual live weight body development, absolute and relative quantity of nutritive elements consumed and from other points of view also (health, etc.). The advertising in recent years of milk substitutes prepared by industrial processes is in direct contradiction to these practical results, based on figures. This praise is therefore unjustified.

The authors examine the results obtained by the use of milk substitutes, especially in connection with their researches on supplementary feeds. They finally attribute the results obtaind to the fact that most of these substitutes contain nitrogenous matter of low value and mineral salts in ill-balanced proportions, for they contain no vitamines. To these defects, common to all milk substitutes, should be added cost of preparation, which is often wrongly estimated, but which undoubtedly decreases the economic value of these products.

Basing on the results of their experiments, the authors strongly advise Swiss breeders to keep to the whole milk system of rearing, supplemented by unmixed concentrated feeds and hay, and not to be tempted into buying industrial and apparently cheaper milk substitutes. A.

610. **Milk Testing of the Salers Breed.**

GENESTE F. (Directeur des Services agricoles du Cantal). Contrôle laitier de la race Salers. *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. XI, No. 9, pp. 332-336. Paris, 1925.

A milk testing competition has been organised by the "Société d'Encouragement à l'Agriculture du Cantal"; 10 dairies have been inspected. Every month the Society's inspector paid a surprise visit to each of them. The milk of each cow, at both milkings, was weighed by him and a sample taken; the sample was sent to the Laboratory of the Agricultural College for analysis. The results were calculated after 300 days' inspection, i. e. a normal period of inspection.

The examination was made on 300 animals and then on 233, one dairy having been attacked by foot and mouth disease.

Of the 223 cows inspected, 14 gave more than 4000 kg. of milk, the maximum being 4775 kg.; 62 others gave more than 3000 kg. during their period of lactation.

The average annual yield of milk of a Salers cow varied between 3770 and 2194 kg.; average, 2810 kg.

The fat was estimated by the GERBER method; the average content varied from 38.8 to 43.4 gm. per litre. The lowest content was observed in the morning's milking, in April and especially in July: 30 gm. of fat per litre.

The annual average richness of the milk from the Salers breed may be estimated at 40-41 gm. per litre

The average total solids varied: in the morning between 135 and 139.7 gm.; in the evening, between 136.6 and 142 gm.; in Autumn the total solids sometimes reached 189 gm. The average annual total solids may be put at 138-139 gm. The figure for solids less fat is very high in the Salers breed, the average varying between 97 and 99.5 gm. The lowest contents 92 and 94 gm., were obtained in April, shortly after calving. P. D.

611. **Pig Breeding in Tunis.**

LÉGER C. (Breeder at St. Germain, Tunis) and TOURNIEROUX J. A., (Inspector of Agriculture at Tunis). L'élevage du porc en Tunisie. *Bulletin de la Direction Générale de l'Agriculture, du Commerce et de la Colonisation*, Year 28, No. 117, pp. 267-311,8 figs. Tunis, 1924 (received in 1925).

From the declarations made by the owners of animals and verified by the Controllers of the Returns, there were, in 1920, 18 699 pigs in Tunisia of which 7 824 were under, and 10 875 over 10 months.

Pig-breeding is carried on in the north and north-east of the Regency, to the north of a line running from Tunis to Kef, and principally in the districts of Tabarka, Tunis, Biserta, Belja and Suk-el-Arba.

The breeds of swine exploited in Tunisia are not native to that Country. They have been imported from Algeria, Italy, Malta and France.

That known as the *Tunisian* variety is the result of a mixture of varieties of the Iberian breed in which the Romagnole reddish-white and Neapolitan black or black-and-white breeds predominate.

The Tunisian variety has horizontal ears pointed forward, an elongated head, tapering snout, short neck and long body and limbs. The skin is sometimes white, sometimes black or black-and-white. The bristles are generally abundant and coarse, especially over the spine and the shoulders of the less improved members are grey, black or reddish-white.

The Tunisian swine are vigorous, hardy, and good walkers and rooters; they thrive well on pasture and forest-land. They are slow in maturing, their form leaves something to be desired, their muscular system is too much developed and they are mostly adapted for meat production.

The Tunisian pig is admittedly defective for sty-rearing owing to its slow development.

The breeders on the outskitts of the town have turned for breeding animals to early maturity breeds: the Craonese, Roma-Craonese cross and Yorkshire.

Crossing the Tunisian with the Craonese gives good results; the pigs are resistant to the Tunis climate and are earlier maturing than the native breed. The pure Tunis breed has to a great extent been replaced by this cross breed, which has proved superior for sty-breeding.

Crossed with the native sows, the Roman-Craonese produce hardy and comparatively early maturing breeds.

The Yorkshire breed crossed with the Roman-Tunis-Craonese increases earliness and yield. At present the Yorkshire-Craonese cross

is pure or mixed with the Tunis, and is often met with as sty-bred on the pig-breeding farms.

The authors next study feeding and deal with the various substances at the disposal of the Tunis breeders, both on the breeding farms and on the market.

The market price of the potato, owing to growth exigencies and the low yield in Tunis, is too high for the potato to be utilised as a pig feed. The mangel, sown in October, December or February according to the district, yields, without irrigation, 25 000 to 50 000 kg. of roots per ha. ready for consumption from June onwards. They keep in the soil until August in the neighbourhood of Tunis and until December or January at Zaghuan, Mateur and Belja.

Fodder carrots succeed well in Tunis; sown from 1 August up to 15 October and irrigated until the autumn rains, they give a comparatively high yield. The crop is harvested from the end of December until the end of May, i. e. until the beets can be utilised.

The grains employed as pig feeds in Tunis are: maize, barley, broadbeans and sorghum; the last-named is very suitable for this purpose with the addition of $^1/_8$ broad-beans or ground-nut cake.

Acorns are used in the north and north-west of the Country. Prickly pears, deprived of their thorns, constitute a feed from August to October which, though not very rich, is useful, and the pigs are very fond of it. For rearing, and especially for fattening, pigs, the authors recommend the cultivation of the melon or pumpkin of the Touraine variety.

The following are also available: unscreened barley and maize flour and wheat offals, small wheat, wheat bran, Rufisc ground-nut cake, coconut cake, maize-gluten, molasses, fig distillery residues, fresh blood and green bone powder. In Tunis, buttermilk and skimmed milk are rare owing to the undeveloped milk industry.

In Tunis there are two methods of production: (1) sty-rearing, and (2) mixed rearing or demi-sty, on the feeds available at the farm, or supplemented by hiring feeding-grounds.

Sty-rearing is only economically possible in the neighbourhood of large towns, where breeders can procure residues from various sources cheaply; 28 % of the Tunis swine raised on the outskirts of Tunis and Biserta are reared in this way.

For sty-rearing the breeders find it advantageous to construct permanent, simple sties, of which the authors give the plan and details of construction.

In Tunis, swine are slaughtered and sold as fresh meat (1) throughout the year by the pork butchers, who require fat or very fat animals of from 80 to 120 kg.; (2) from October to April by certain butchers who retail fat, and especially half-fat, pigs of from 70 to 80 kg. The most important exports take place in December-January, and comprise half-fat, fat and very fat animals.

In sty-rearing, the variety which, with the same feed and care, most quickly attains the weight and degree of fattening required by the pork butchers, butchers or exporters, should be exploited.

[611]

The best varieties are the Craonese, Tunis-Craonese cross and Tunis-Yorkshire-Craonese cross. The Tunis variety is admittedly disadvantageous.

The breeding pigs intended for sty-rearing should be selected from among those with the longest and widest bodies possible.

The replacing of breeding-pigs is carried out by two methods: selection, keeping the animals which are most remarkable for shape and earliness, and at the same time, by replacing the boar, avoiding too close consanguinity; or by taking selected breeding-animals from a breeding-farm (annexe of the Colonial School of Agriculture).

The authors then examine the qualities which should be possessed by boars and sows, the production of young pigs, pairing, gestation, parturition, feeding of sows during suckling, weaning of sucking-pigs, castration, feeding, etc.

Owing to the Tunis climate, fattening in the sty should take place from October to May; fattening is begun when the animals reach 55 to 80 kg., i. e. at about the age of 7-14 months, according to the earliness of the variety and the breed.

The authors give advice as to rapid fattening and types of feeding for the first and second fattening periods.

Half-sty-rearing without the hire of feeding grounds. — This is advantageous on many farms in North Tunis owing to their extent and natural resources in feeds utilisable for pigs. In this system the sty is considered as a temporary structure and should be built as economically as possible, at the rate of 1 sq. metre for every 4 breeding pigs and 1 sq. m. per 3 ½ head for store pigs.

The Tunis-Craonese cross is the best breed under this system as the Tunis breed is too slow in maturing.

The herd should include a boar, sows of from 1-2 years and pigs for raising of from 4 months to 1 year.

The best times for sending the herd out to pasture on the farm are the spring and beginning of autumn, owing to the abundance of feed at those periods.

After the autumn rains and until May-June, the pigs find plenty of feed. Generally speaking, the period of scarcity is of short duration, the more so that after the harvest the animals can be pastured on the stubble. If the period of scarcity is prolonged, a supplement is given in the evening after the return from pasture.

The best periods for mating are September-October or April-May, so that the young pigs are born in January-February or August-September. Sows which are well cared for give two litters yearly. The boar is separated from the sows during part of the year.

During gestation, if pasture is not very rich, 0.500 to 0.800 kg. of bran are added to the feed. The sow, after parturition, goes to pasture in the morning, is brought back at midday to suckle the young pigs, and then returns to pasture until the evening.

During suckling, it is advisable to give the sows a supplement of concentrated feeds: 0.600 to 1.200 of barley mash, dari or bran.

After weaning, the young pigs are sent to pasture when the weather is fine; care must be taken at the period of passing from suckling to pasturage or a stoppage in the growth of the young pigs will be caused; to avoid this they should, for two months, be given a ration of crushed or soakep barley mixed with dry grain. This feed, starting at 300 to 400 gms., is progressively decreased and ceases at the end of eight weeks.

Castration should be done at the age of 3 or 4 months.

In times of scarcity the animals are given additional food: from 2 to 5 kg. of boiled beets and 0.5 to 1 kg. of dari, barley bran or maize per head per day according to age and the quality of pasture.

The pasture lasts from 4-6 years, and the less rich the soil and the greater the number of head put out to pasture, the sooner it becomes exhausted.

When the pasture and stubble suffice for feeding the pigs, rearing without the hire of feeding-grounds is very lucrative, requires no great outlay for buildings and does not interfere with the raising of cattle or sheep. The difficulty in this case is that of tending.

The hiring of feeding-grounds in connection with rearing. — This system is followed by certain farmers from the end of October, when their own pasture becomes exhausted, until the middle of June, when harvest begins and the stubbles become available.

The forest feeding grounds advantageous for swine-rearing are formed of the oak plantations in the districts of Tabarka, Sus-el-Arba and Bizerta. The cork-oak is the predominant species; it fruits annually and the swineprefer the acorns of this species, which fall from the end of November until the end of February.

The zeen-oak grows in the cool soil of the valleys, fruits twice a year, and the acorns fall from the end of October until the end of December. To render them fit for consumption by the pigs, germination should have commenced, thus decreasing their astringency.

The evergreen-oak grows in varying quantities with the cork-oak and its acorns fall from the end of January until the beginning of May; they are the least sought after by the pigs.

Dense and vigorous plantations of these three species of oaks provide a good feeding ground; the fall of acorns lasts from November to May. The underwood however should not be impenetrable, nor should the ground be too high or exposed to the north, also there should be springs or water courses which do not dry up before the middle of June.

The feeding grounds are preferably leased to those dwelling along the forest border. Good feeding grounds are seldom available; where obtained, the hirer must come to terms with the previous tenant as regards indemnity for the buildings which the latter has erectd.

The authors give in detail the regulations for swine forest feeding grounds and a list of the charges incurred by leaseolders. Before sending herd to the feeding ground, the breeder should, by a careful inspection of the area, ascertain the number of pigs it can support, basing on the supply of acorns. The advice of the district forest-keeper and of an experienced breeder should be taken. The forest shelters or huts ore

constructed very roughly, near a spring or water-course, on soil which is not clay, sloping, and preferably in a clearing ; 3 to 3 ½ pigs are reckoned per sq. metre.

The recruiting of swine herds is fairly easy among the native tribes of the forest zone, but difficult from among the other tribes. Two swine herds are required per herd of 80-120 pigs. The wages are at present from 75 to 100 francs per swine herd for the 7-8 months of feeding.

For the production of young pigs, the same variety of animals are used as in raising without the hire of feeding grounds : the births should take place in January-February or in July-August. A supplementary ration of acorns or barley is given to the sows in pig ; likewise during suckling they receive in winter 1 ½-2 litres of barley in the evening, and in summer, morning and evening, a ration of boiled beets and barley, the quantity increasing progressively from 1 litre to 3 litres.

The young pigs should not be sent to the feeding ground before the age of 4-5 months for fear of the jackals ; nor should they be sent there during rain, snow or hail, otherwise mortality is high.

The herds on the feeding grounds should be carefully watched, for, if left to themselves, the native swine herds are very careless ; the owner should make frequent visits to the ground, count the animals, superntend the distribution of the supplementary ration, indicate the part of the ground where the herd should be led, etc.

Stubble follows acorns. The breeder often makes arrangements with a large cereal proprietor for pasturing on the stubble from the middle of June until 15 October. The proprietor takes over the herd after it has been weighed, and undertakes tending at his own cost. When the breeder takes back the herd, it is again weighed and the proprietor is paid half the value of the increase at a rate agreed on beforehand. Sometimes the stubble is simply hired and tending is at the expense of the breeder. As far as possible stubble should be chosen where the animals find water for bathing during the heat of the day. The value of a stubble-feed depends on the quantity of feed-plants grown by the soil in addition to the ears of cereals and the texture of the soil.

Between the fall of acorns and harvest there is a longer or shorter transition period according to the abundance of acorns and the spring rains. When the acorns are exhausted, rootable pasture should be procured for the pigs or they should be given an additional feed of 300-500 gms. of barley or bran.

At weaning (2 ½ months) the young pigs weigh 12 to 16 kg. ; at 6 months, 20-30 kg., and at 1 year 50-60 kg., if they have been reared well on the half-sty system. The swine sent to pasture at the age of 13-15 months weigh 50-60 kg. ; if acorns are abundant, they reach 70-80 kg. at about 18 months. They are then half-fat, and are sold either to the butchers or to the fatteners, who keep them 30-45 days in the sty and then sell them fat or very fat ; sometimes the breeder carries out this latter operation himself. It is generally advantageous to deliver fat or very fat pigs, for the sale price per kg. is higher than for half-fat animals.

The active supervision necessary in half-sty rearing with hiring of feeding ground has led breeders to hire out the animals on the following conditions :

The breeder supplies the herd, shelters, and stubble, and pays the hire of feeding ground. The landlord undertakes the rearing and superintending, and receives half the profit realised on the herd.

The financial results of half-sty rearing with hire of feeding ground are irregular. Generally speaking, for 100 swine reared and sold fat or very fat, the sale price of 75 covers expenses and that of the remaining 25 represents net profit.

The authors then deal with the chief diseases of swine, and which breeders should know how to recognize and treat, as the breeding farms are often far from districts where there is a veterinary surgeon. The following are discussed: scab, lice, diarrhoea, angina, heat-stroke, foot and-mouth disease, the symptoms of each disease being given and the remedies to be applied. P. D.

Poultry.

12. **The Evolution of Potentialities in Chickens.**

PEZARD, SAND and CARIDROIT. L'évolution des potentialités chez la poulotte. *Comptes rendus des Séances de la Société de Biologie et de ses filiales*, Vol. XCII, No. 7, pp. 495-496. Paris, 1925.

Ovariectomy causes the appearance of the cock's plumage in the hen. It has been concluded therefrom that the male plumage exists in a potential state in the adult hen and that it is blocked by an ovary secretion.

Certain breeds of poultry show precocious sexual dimorphism, differing from the definite dimorphism. The authors have examined generation G birds of the Silver Dorking × Golden Leghorn cross to find out whether the hen shows a synchronic male potential evolution, i. e. whether precocious ovariectomy is followed by the appearance of the adult male plumage or by that of the young male.

The plumage evolution normally presents 3 successive aspects:

(1) *Chick down:* lasting from 15-20 days; aspect and colouring similar in both sexes.

(2) *Early plumage:* in the young female bird this plumage at first has the form and pigmentation of the adult.

(3) *Adult plumage:* the metamorphosis only takes place in the cock; the final plumage becomes established towards the age of 3 months, the transformation requiring about 1 month, during which there is juxtaposition of early and adult plumage.

If ovariectomy be performed on a young pullet, she is observed to acquire the plumage of the young cockerel which serves as a check, and not that of the adult cock. At a certain moment, the ovaryectomised pullet presents a remarkable case of mottling, for he shows three different plumages: (*a*) young pullet's, (*b*) cockerel's, (*c*) cock's.

There is juxtaposition of an abnormal gynandromorphism (young pullet plus cockerel) and of a pseudo gynandromorphism (cockerel plus cock).

Ovariectomy shows that the potentialities of the hen's plumage also apply to the precocious characters.

The immature ovary exercises an endocrinian influence over the plumage, and consequently the hormonic action of the ovary must be considered as very precocious. P. D.

613. **Growth of Single Comb White Leghorn Chickens.**

LATIMER, H. B. (Department of Zoology and Anatomy, University of Nebraska). Postnatal growth of the body, systems and organs of the single comb White Leghorn Chicken. *Journal of Agricultural Research*, Vol. XXIX, No. 8, pp. 363-397, 21 figs., bibliography. Washington, D. C., 1925.

In his experiments the author used single comb White Leghorn chickens, supplied by the Division of Poultry Husbandry, and divided into 4 groups. From the beginning of the test the chickens received a mixture of maize and a paste, both purchased on the market. Afterwards the feed was placed in hoppers containing equal quantities by weight of the following: bran, bran plus maize gluten (hominy), wheat offals, ground oats and meat meal.

As soon as the chickens were large enough, they were given a mixture of crushed grain: maize, oats, etc., and then, whole grain. They also had milk at their disposal. Later they were given, in addition to the usual ration of grain, a paste composed as follows: maize flour 6 kgs., ground oats 6 kgs., wheat offals 4 kgs., bran 2 kgs., lucerne meal 2 kgs., meat offal 7 kgs., ¼ kg. of charcoal, 1 % of common salt and 3% of bone meal.

A complete autopsy was made on 100 normal chickens: 50 from group 1, 15 from each of the groups 2 and 3, 14 from group 4, and 6 older chickens as checks.

The chickens in group 1 were weighed once a week; those in the other groups every day at first, then 3 times a week. The weighings took place in the morning, before the chickens received their feed and were set at liberty. Those of the same group were weighed at the same time in order to determine as nearly as possible the average weight per chicken.

In the choice of those selected for the autopsy, chickens of different ages were taken, the weight of which was as near as possible that indicated by KIRKPATRICK as the normal weight of the chicken at the age in question.

The author then describes in detail the process followed for determining the weight of the different organs and the lineal measurements.

The data collected on the special cards for each of the birds subjected to autopsy then served for calculating and constructing the different curves and graphs contained in the publication. The author gives detailed information of the method adopted and the empiric formulae utilised in calculating the curves.

The principal conclusions arrived at through this investigation are as follows:

(1) The curve of postnatal growth and of the whole body of the chicken shows 3 chief phases: first a period of slight growth, including a decrease in weight of short duration; a second period of rapid growth, during which a difference in body weight according to sex begins to show itself; finally a third period of slow increase in weight.

(2) There is a great difference in the weight of the head as between the sexes, probably due to the greater development of the crest and wattles in the male.

(3) The increased weight of the skin (not including the feathers) is in direct proportion to that of the entire body: the skin forms about 9 % of the net weight of the body.

The plumage increases in actual and relative weight until sexual maturity; then there is a decrease in net and relative weight and the growth curve of the plumage afterwards rather resembles that of the thymus.

(4) The muscular system increases from 21.22 % of the weight of the body, up to 50 % in the case of in adults.

(5) At the beginning, the skeleton increase in weight a little less quickly than the entire body; it is 11 % of the weight of the body in the male adult and 8 % in the female. The weights and lineal measurements show that the skeleton of the female develops more quickly than that of the male.

(6) The digestive tract and its dependencies (proventricle, gizzard and intestines, pancreas) show an initial increase in relative weight of short duration, followed by a slight decrease of this weight up to maturity.

The empty digestive tract reaches a maximum of 18.5 % of the body weight at the age of 6 days, decreasing to about 5 % of the body weight in adults.

The weight of the contents of the digestive tract is extremely variable. The vitelline sac was found in all the dissected chickens up to the 38th day inclusive; with one exception, it was afterwards found in chickens until the 237th day.

MECKEL's diverticulum is always present.

(7) The liver decreases in weight from a maximum of 6.2 % of the body weight in all the young birds to about 2.5 % of this weight in adults. Its weight increases considerably in the older birds, and especially in fat hens.

(8) The weight of the trachea and lungs varies, and shows a decided difference according to sex, being higher in the adult male chickens.

(9) The heart shows a considerable increase, both in actual and percentage weight, this increase taking place at the end of the growth period, commencing when the gross weight of the body reaches 1400 gms.

(10) The upper portion of the curve representing the actual weight of the thyroid gland is entirely concave. The % values vary from the moment the gross weight of the body raaches a minimum of 200 gms. until it reaches a maximum of 400 gms.

(11) Both the relative and absolute weight of the thymus increases until maturity, then shows a retrograde movement, decreasing in relative and absolute weight. These modifications are more closely connected with age than body weight.

(12) The suprarenal glands and the pituitary gland vary somewhat in weight, but do not show ay difference as between the sexes.

(13) The kidneys show a decided initial increase from 0.6 % on the day of hatching to 5 % of the body weight at the age of 5 days ; this initial increase is followed by a slow decrease to about 0.6 % of the body weight in adult birds.

(14) The ovary, oviduct, testicles, comb and wattles vary greatly in weight. These organs have a tendancy to form a growth curve of 4 phases, with a notable acceleration of increase at the age of puberty.

(15) The brain, backbone and pupils of the eyes quickly increase in weight at the start, and afterwards more slowly. The relative weight (%) of these organs does not show an initial increase, but gradually decreases from the time of hatching.

P. D.

FARM ENGINEERING.

Irrigation.

614. The Relation between Water Supply and Plant Growth on Irrigated Land.

SUTTON W. C. *South African Irrigation Magazine*, Vol. III, No. 4, pp. 275-280. Pretoria, 1924.

The irrigation farmer is faced with the problem of how the crop will respond to the application of water, and how rapidly it will consume the water stored in the soil. The author's investigations were carried out to determine the relation between crop yield and the amount of water used by the plant in growing to maturity.

Various areas were reserved for the experiment : in one the soil was uniformly fertile, another was of average fertility and a third was uniformly poor land. A very large number of plots were employed, to which were given different quantities of water. The results were plotted out in graphs, as shown on page 912, from which it is seen that in the case of wheat, on fertile land the maximum yields was obtained with about 21 in. of water, for average soil 22 in., and for poor land about 26 in.

[614]

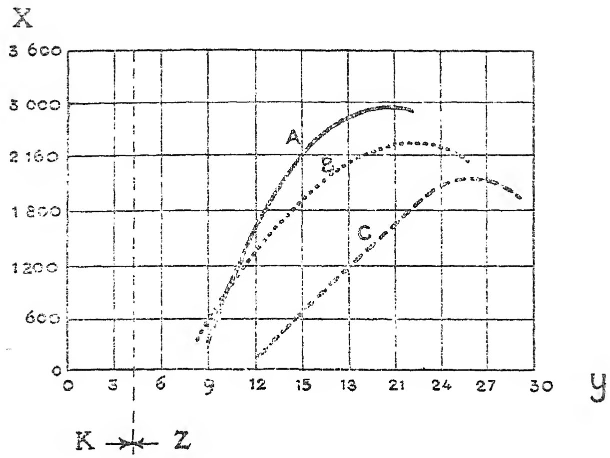


FIG. 131. — Relation between quantity of water used and yield of wheat.

X = Yield in pounds per acre.
Y = Total quantity of water absorbed in inches (sum of soil water and irrigation water absorbed by plant — rainfall 4 ¼ inches).
A = Fertile soil: B = average soil: C = poor soil.

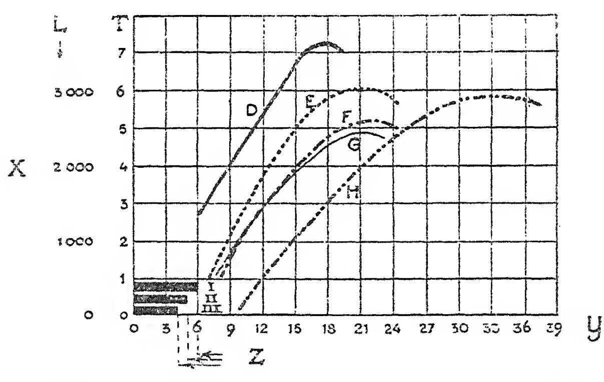


FIG. 132. — Quantity of water used and yield of crops on average soil.

X = Yield per acre.
Y = Total quantity of water absorbed in inches (irrigation and soil waters).
Rainfall: potatoes 6 ins., lucerne 5 ins., cereals 4 ¼ ins.
D = potatoes (tons); E = oats; F = wheat; G = barley;
H = lucerne (tons(, L = pounds: T tons.
I = Potatoes; II = lucerne; III = cereals.

From the curves it is seen that the yield increases with the increase of water, up to a certain point, after which further application of water causes a reduction in yield. It is generally sound policy to apply less water than the amount necessary to produce maximum yield per unit area. The irrigator should try to stimulate the yield of that part of the crop which is of greatest value, as this can be controlled to a considerable extent by the time of application of water; *e.g.*, irrigation at the wrong time will stimulate the growth of the straw of wheat, rather that the grain.

The collection of data and preparation of charts will indicate the total amount of water that a farmer can economically use under an efficient scheme of irrigation. The value of such figures is of the utmost importance in controlling sound economic proportioning in the design of an irrigation scheme. W. S. G.

615. **A Short History of Irrigation in South Africa.**

LINSCOTT, C. O. *South African Irrigation Department Magazine*, Vol. III, No. 2, pp. 50-58. Pretoria, 1924.

The author gives a brief outline of the first settlement at the Cape in 1652, and passes on to the year 1820 when 4000 farms were allotted to British settlers, about which time irrigation spread rapidly. In 1900 Sir William Willcocks was sent out by the Government to examine the irrigation possibilities of Cape Colony, Orange River Colony and the Transvaal, and in 1923 the Irrigation Department was formed.

The potential irrigable area in the Union of South Africa is given as 3 000 000 acres, of which area a little over 25 % is now under irrigation. The present total storage capacity is 25,220,000,000 cubic feet. In many districts new constructions and extensions of present irrigation works are taking place. W. S. G.

Methods of Cultivation.

616. **Cultivation of Wheat in Austria by the Spaced-Row and Hoeing System.**

I. — PRIMITZ (Oekonomieverwalter). Die Getreidehackkultur, figs. 12, pp. 24, Verlag Gerold, Vienna, 1924.

II. — GROYSBECK (Gutsbesitzer). Die Hackkultur des Getreides mit Ackerbeetkultur, pp. 27. Vienna, 1924.

III. — PRIMITZ (Oekonomierat), Hackultur. *Die Agrarische Woche der Landes-Landwirtschaftskammer* 19. bis 23. Mai, 1924, pp. 5. Vienna, 1924.

IV. — ALBRECHT (Konsulent für Pflanzenbau). Die Hackultur beim Getreidebau. *Mitteilungen der Niederösterreichischen Landes-Landwirtschaftskammer*, No. 9, p. 2. Vienna, 1923.

V. — SCHIESSTL, Reform-Getreidebau, published by the Author at Klein-Soell, Post Kundl, Tyrol.

VI. — Schriften des Vereins zur Förderung der Ackerbeetkultur in Linz.

VII. — Merkblätter der Beratungsstelle für Ackerbeetkultur in Wien. II, Diestlergasse 10.

VIII. — Merkblatt des Bundesministeriums für Heereswesen für die chinesische Ackerbeetkultur, z. 1260 der Abt. VII, 1922.

IX. — PAWLIK (Gutsdirektor). Erfahrungen mit der Hackkultur. *Wiener landwirtschaftliche Zeitung*, No. 81, p 1, 3rd October, 1924, Vienna.

X. — MITTERHAVSER (Direktor der landwirtschaflichen Schule in Wiegelsdorf. Ergebnisse der Getreidehackkultur an der landwirtschaflichen Landeslehranstalt in Wiegelsdorf. *Weiner landwirtschaftliche Zeitung*, No. 81, p. 1. Vienna, 1925.

Encouraged by the results which had been obtained in Germany bgyrowing wheat in rows with wide spaces between, and also by the teaching of DEMSCHINSKY, many farmers in Austria have been engaged for years with the question of the introduction of the hoeing system into the latter Country. The effort to increase field production and thereby improve the food supply has also helped in this direction.

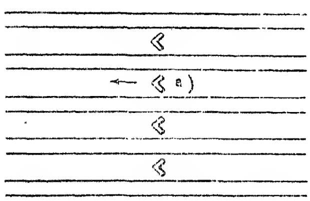


FIG. 133. — Method of hoeing *a* direction of furrow.

The method may be carried out in three ways: the first is to try the old method followed in China of frequent transplanting, and repeated earthing up of each separate plant, and to bring this method into general use. The tests however have shown that this practice may be followed in gardens, but that the greater expenditure for labour is out of proportion to the increase in yield. Small field tests have shown that this process after a long trial has not been attended with the desired results under the more unfavourable soil conditions found in the dry Austrian climate.

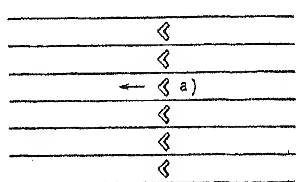


FIG. 134. — *a* = direction of furrow.

The second tendency is towards the single grain sowing by specially constructed seed drills. The field must be cultivated and the wheat earthed up. This method also failed to give the desired results. The sparsely sown grain was to a large extent exposed to the attack of animal pests, and as gaps could not be avoided, either through the machine not working in places tr through the low germination of the grain sown, many places on ohe field remained vacant. Hence yields fell and weeds flourished. The slight rainfall, averaging 500 mm. yearly in the principal corn-growing districts of Austria, hindered tillering, and the development of ears and grains which had formed, hence yields were seldom large and often poor in quality.

In the third method followed, the usual push-wheel drill was used. As a variation from the ordinary sowing, however, some of the seed-drill shares were removed. For sowing in rows whit spaces between, every third share was taken off and only two left to work (a), so that a series of rows are formed with spaces between, and thus cultivation can be properly done.

For sowing in widely-spaced rows, every second share is taken off, so that only the alternate drills (a) function. Thereby regular, wide spaces are left between the rows of wheat which are hoed.

In ordinary sowing, the soil always remains untilled between each double, dense row. Here there is no aeration, earthing-up or weeding; hence yields are much smaller than when sowing is done in widely-spaced rows, and most farmers have abandoned the former method. Only farmers who are anxious not to lose a row of germinating corn, to compensate for any loss which may arise, as for instance through wintering and frost, still keep to it, for in this case they still have the corn of the second row, which is not the case when similar losses accour in spaced-row sowing. But these considerations are of no practical importance.

Spaced-row sowing has mostly come into favour. It can of course only be done where the soil is well tilled and not over-run with weeds, where good seed is used and careful cultivation of the wheat is possible.

Basing on experience gained up to the present, about the following quantity of seed is grown per ha:

	kg.
winter wheat	100
" barley	90
" rye	100
summer wheat	90
" barley	90
" oats	80

These quantities are 40 - 60 % less than those used in ordinary machine-drill sowing.

Field crops sown in autumn are cultivated in the autumn and spring. Winter wheat, which responds especially well to hoeing, is, where possible, again hoed in spring after about 70 kg. of nitrate of soda per ha. have been applied to the soil shortly before.

For spring crops it has been found necessary to sow very early, so that hoeing may follow at a time when the winter moisture is still remains in the upper soil layers at the disposal of the young plants, as they need this for a strong stem growth.

Oats respond to row-sowing better than barley or summer wheat, because they have a stronger stem growth. Winter crops are always better than those sown in spring.

After several field tests, carried out on a large scale at Immendorf, the tillering of winter wheat, after spaced-row and ordinary machine-sowing, was on an average as follows:

spaced rows

27	plants	with	1 stem	=	27	stems
25	,,	,,	2 stems	=	50	,,
19	,,	,,	3 ,,	=	57	,,
8	,,	,,	4 ,,	=	32	,,
1	,,	,,	5 ,,	=	5	,,
3	,,	,,	6 ,,	=	18	,,
2	,,	,,	7 ,,	=	14	,,
2	,,	,,	9 ,,	=	18	,,
1	,,	,,	10 ,,	=	10	,,
1	,,	,,	11 ,,	=	11	,,
1	,,	,,	19 ,,	=	19	,,
90	plants	with a total of			261	stems

ordinary machine-sown

142	plants	with	1 stem	=	142	stems
15	,,	,,	2 stems	=	30	,,
3	,,	,,	3 ,,	=	9	,,
5	,,	,,	4 ,,	=	20	,,
2	,,	,,	5 ,,	=	10	,,
167	plants	with a total of			211	stems

The average stem growth with spaced rows was therefore 2.9, with ordinary sowing, 1.2 stems.

On the Immendorf estate, the winter wheat yields in 1922 were *eleven times* the quantity of seed sown by the *ordinary method*, and 24 times that shown in *spaced rows*.

In 1923 ordinary sowing gave a 14-fold increase, and spaced rows a 26-fold increase.

In 1924 the proportions were: 11 times by the ordinary, as against 19 times by the spaced row method.

Even in this comparatively infavourable year the yields per joch (1 joch = 0.5754 ha.) were:

980 kg of grain from 86 kg, ordinary sowing, and 1112 kg from 56 kg spaced row sowing.

Summer barley 1922:

Ordinary sowing	88 kg. seed, 1300 kg. yield
Spaced row ,, ...	60 ,, ,, 1400 ,, ,,
Winter rye 1924:	
Ordinary sowing	104 kg. seed, 1050 kg. yield
Summer barley 1924:	
Ordinary sowing	84 kg. seed, 1090 kg. yield
Spaced row ,, ...	48 ,, ,, 1224 ,, ,,
Oats 1924:	
Ordinary sowing	65 kg. seed, 1020 kg. yeld
Spaced row ,, ...	40 ,, ,, 1210 ,, ,,

In most cases the cost of hoeing was covered by the value of the seed saved in sowing, so that the increased yields of grain and straw represent a net profit.

The following results obtained in practice are also worthy of attentions wheat grown in spaced rows has a stronger stem and does not lodge so easily as the other.

PAWLIK reports the following test and its results :

On a field in which mangolds had been grown and fertilised with stable manure and potash the previous year, oats were grown, in locs I and II in rows with a distance of 10 cm. between and in lot III, with a distance of 20 cm. between the rows. No preliminary treatment was applied to lot I. Lot II, after the germination of the oats, was harrowed with a heavy iron harrow, and lot III was hoed once.

The yields per ha were as follows :

	Grain — kg.	Straw — kg.
Lot I (untilled)	14.8	25.3
" II (harrowed)	15.2	29.2
" III (hoed)	18.2	43.9

In contrast to these favourable results, other less satisfactory ones were occasionally obtained. But the latter was mostly the case only when the field was heavily overgrown with weeds, which, in the wide spaces between the wheat obtained more light and grew better. An excessive growth of weeds, therefore, to the detriment of the wheat was observed especially where hoeing was not done at the right time. A high earthing up of the wheat when in dry surroundings and with a light soil, also proved to be a mistake. Through earthing-up, tillers of the young plant were covered, and root-laterals and new tillers developed. But as there was not sufficient moisture in the soil to furnish a proper supply of water to these shoots, they could not develop, or only at the expense of the other stems. Scarcely so much straw therefore was obtained, and less and, especially, lighter grain, than by the ordinary method. Where the soil was hoed but not ridged, these unfavourable results did not occur where a good quality of soil rendered possible vigorous stem-growth. On quite poor soils, as for instance the grounds of the Agricultural Station at Weigelsdorf, a vigorous stem growth is not usual. There the yields from a thin sowing are much below those obtained from the customary thick sowing.

The yields obtained per ha. were :

	Rye — kg.	Straw — kg.
ordinary sowing.	19.60	56.20
sowing in rows (every 3rd share taken off).	14.34 (hoed twice)	51.00
spaced rows (alternate shares taken off)	13.40 (" ")	43.60

Fig. 136 (Plate LX) shows a simple, light hoe, which can be so turned by the driver as to avoid damaging the rows. The hoeing gear is fastened

by a bolt to the fore-carriage. To ensure easy running of the gear, left and right of this bolt is a smooth iron bar (S), on which the gear slides backwards and forwards.

The method of working is shown in fig. 135, and Fig. 137 (Plate LX) shows how the machiue works. It is built according to the plans of PRIMITZ, Immendorf (Lower Austria) by the " Ora ", Babenbergerstrasse 5, Vienna I.

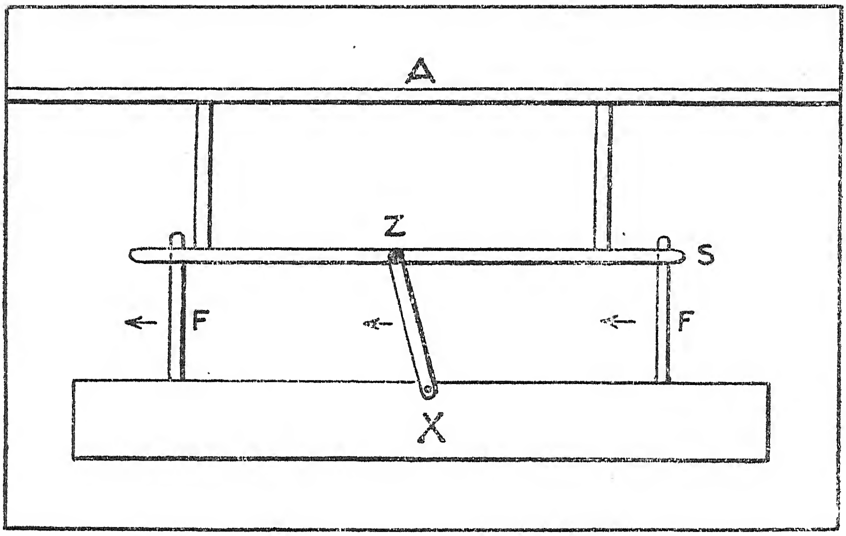


FIG. 135. — Hoeing gear.

Detailed plan of hoeing gear, which is pivoted by the bolt Z to the forecarriage. The position of the gear is set over to the right. The arrows show how the gear can be brought over to the left. In order to lighten the weight on the steering-gear, 2 guiding rods (F) are fastened to the apparatus, which move backwards and forwards on bar (S) which is connected strongly with the fore-carriage.

Besides this apparatus, there are many other types in use, *e.g.* small 2-wheel machines (Plate LXI, fig. 138). Plate LXII, Fig. 139, shows cultivation with an ordinary seed drill, from which every second drill has been taken off; Fig. 140, the condition of the wheat after hoeing, Figs. 141 and 142 (Plate LXIII). the same after the formation of the ears. These figures show the excellent growth and vigorous development of all parts, in fields under the hoeing system.

Field with few weeds can be hoed with machines. Those overgrown wiith weeds must be hoed by hand.

Soils poor in nutrient matter and water cannot produce vigorous tillering of wheat grown thickly in rows. On such the advantage of hoeing, especially that in which earthing up promotes stem growth, was not realised.

The hoeing method is being more and more adopted in Austria, but tests and investigations to an increasing extent are still being made in order to find out the most favourable climatic conditions of the hoeing system.

H. K.

[620-621]

617. Mechanical Tillage on Sugar Plantations.

DASH, Prof. J. S. (Imperial College of Tropical Agriculture, Trinidad). *Tropical Agriculture*, Vol. 1, No. 7, pp. 108-110. Trinidad, 1924.

The main purpose of this article is to draw the attention of planters recent developments in the use of machinery, especially with respect to tillage and cultivation on sugar plantations and in connection with other tropical crops.

The most important object of tillage is modification of soil structure, which affects retention of moisture, aeration, heat absorption, etc., and through these the biological and chemical processes of the soil.

By the adoption of machinery the tillage of cane land can take place during the drier months, instead of partly during the rainy season, thus lessening the risk of damage to clay soils. Larger areas can be worked in a given time and increased crop yields can be obtained.

Labour conditions, even in the tropics, are becoming worse, and the introduction of machinery increases the output per man.

In Hawaii 90 % of the ploughing is done by steam ploughs; a recent introduction is a tractor-drawn planting machine which can plant six acres of cane per day. Another new implement is the « Killefer » subsoiler, of which there are now about fifty in Hawaii; this is a heavy-draught plough requiring a 60 HP.-tractor to break up a hard pan at a depth of 22 inches. This implement has been successfully used in British Guiana where is has been hauled by a cable.

In Porto Rico the Storey plough is employed, a new implement which, instead of share and mouldboard is equipped with revolving knives attached to rotary drums; these knives stir and pulverise the soil to a depth of 8 to 24 inches and leave a fine mulch on the surface. From 5 to 10 acres per day can be worked.

The Howard sugar cane trash cutter and plough has a combination of knives and revolving cutters, which cut cane trash into short lengths, and the trash is then buried by a set of ploughs attached to the rear of the machine.

In Trinidad a heavy disc harrow has recently been employed, fitted, with 30 inch discs. This has been found to be more efficient than the drag type with spikes, and cuts up the trash into short pieces which can then be covered by ploughs. On one estate, with two sets of ploughs and one set of harrows, drawn by a Fowler engine, 700-800 acres can be worked in four months, at an approximate cost of £ 3 per acre for ploughing and harrowing inclusive of labour, fuel, repairs, etc.

The author alludes to the loss of time caused by breakdowns, delays in starting, etc., which may amount to as much as 20% of total working time. By instituting a daily report system to check the work of each driver, better supervision of the machines has resulted and much time has been saved.

W. S. G.

[617]

PLATE LX.

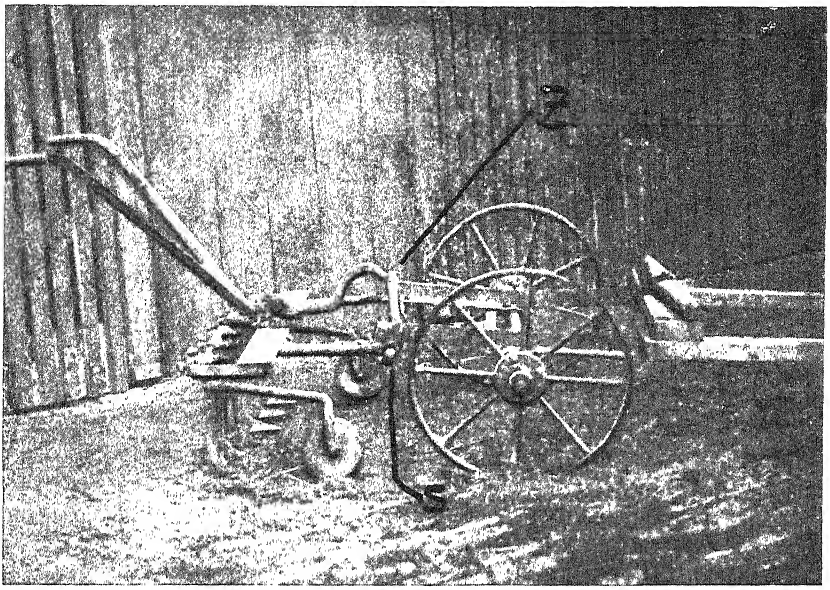


FIG. 136. — "Immendorf" hoe.

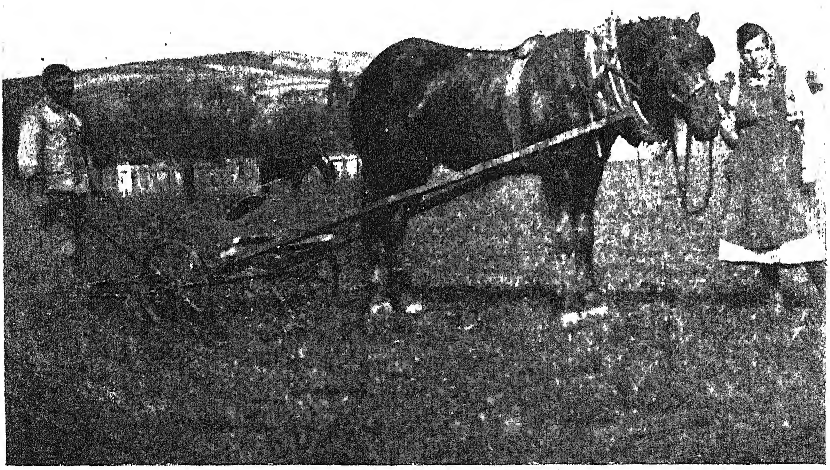


FIG. 137. — Machine ready for hoeing.

FIG. 138. — Hoeing a wheat-field with the single-wheel hoe.

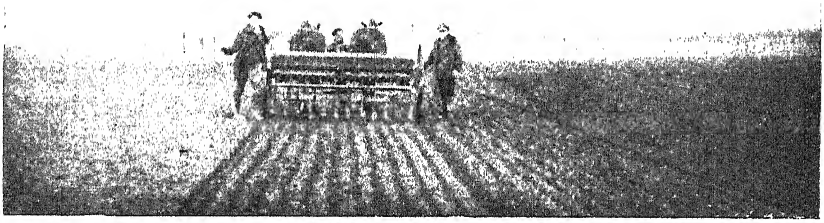


FIG. 139. — Seed-drill for spaced-row sowing and field ready for sowing.

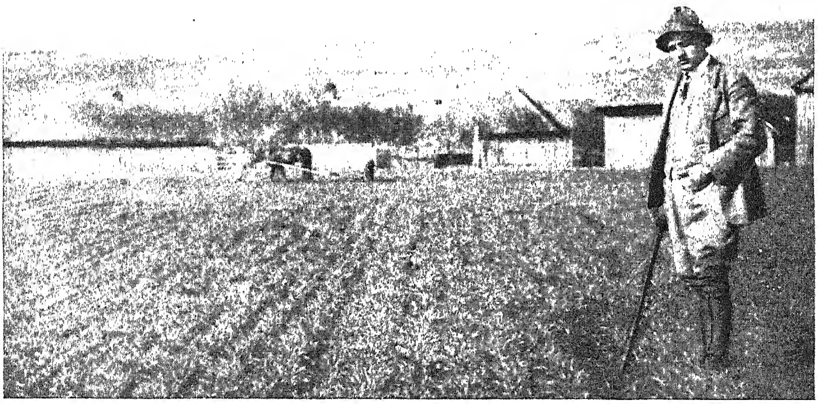


FIG. 140. — Wheat-field after hoeing the previous year.

PLATE LXIII.

FIG. 141. — Rye-field during heading.

FIG. 142. — Oat-field 14 days after heading.

618. **Trials of Sub-Soiling 1924.**

Journal of the Ministry of Agriculture, Vol. XXXI, No. 10, pp. 925-930, tables 6. London, 1925.

The Ministry of Agriculture (London) in cooperation with the East Anglian Institute of Agriculture, in 1923 laid down a series of sub-soiling trials in Essex and further plots were subsoiled in Oxfordshire in 1924.

On a sand and gravel field subsoiled to a depth of 5 in. an increased yield per acre was given of potatoes, worth from £15-£20, and a barley crop following the potatoes was valued at £6 17s 11d per acre more than the crop on plots only ploughed. Where the subsoiling was deeper (7 in. to 9 in.) the increase was less.

In the case of heavy land, with oats grown on plots subsoiled to a depth of 5 in., 7 in. and 9 in., the weights of grain were respectively, 23.4 %, 31.9 % and 25.9 % more than those of the control plot. The weights of straw were 26.8 %, 36.9 %, and 38.7 % more than those of the land not subsoiled.

W. S. G.

619. **Experiments with Fallow in North-Central Montana.**

MORGAN, G. W. *United States Department of Agriculture Bulletin No.* 1310 pp. 15, tables 9. Washington, D. C., 1925.

In the bulletin are given the results of experiments with summer fallow, from 1917-1923 inclusive, at the Assiniboine Field Station. The climatic conditions during the above period were generally unfavourable to crops.

Land which lies over the season in a cultivated condition without, however, bearing a crop, is known as summer fallow ; the system is chiefly confined to arid and semi-arid regions.

The soil, a sandy clay loam, on which the experiments were made is unirrigated land at an altitude of about 1600 feet. The average precipitation from 1880 to 1923 was 13.33 inches, but for the 7 year period of the experiments it was only 11.26 inches.

The yield of the wheat, oats and barley averaged higher on fallow than on disked maize fields or on land cropped continuously with small grain .

The total yields of maize (stover and grain) from fallow were about 1000 lb. more than with any one of the three best methods of continuous maize growing, but maize grown on spring ploughing, autumn ploughing, or subsoiling was produced more economically than that grown on fallow.

The yields of oats and winter wheat after green-manure crops were about half those after fallow.

Ploughing 8 inches deep for fallow was more profitable with oats, barley and winter wheat than ploughing 4 inches deep, or ploughing 8 inches and subsoiling 18 inches. Subsoiling gave higher yields of oats than 8 inches ploughing, but the increased yield was not enough to pay for the additional cost.

W. S. G.

[618-619]

620. **Spacing Experiments : a New Method.**

HARLAND, Prof. S. C. *Tropical Agriculture*, Vol. II, No. 3, p. 67. Trinidad, 1925.

The yield of a crop is mainly determined by the interaction of the two factors, yield per plant, and number of plants per acre. When a crop is introduced into a new country it is very important to ascertain the optimum number of plants per acre. For this purpose the author has devised a spacing technique which is easier to carry out than the method of plots, each devoted to different types of spacing.

The method consists in spacing the plants along a row in a series of gradually diminishing distances, for instance, from 30 inches at one end of the row to 3 inches at the other. The distance between the rows is kept uniform ; other experiments may be made in which the distance between the rows is varied.

To ensure a smooth curve the mean yield of not less than 50 plants at each spacing should be taken, and if possible the probable error of each series calculated.

The results may be shown in a curve in which number of plants per acre is plotted against yield per plant and yield per acre.

The results will fall into a curve which will ascend until the optimum spacing is reached, and will fall as the spacing becomes too close.

Preliminary experiments indicate that the method may be of wide application.

W. S. G.

Machines and Implements.

621. **Recent Innovations in Farm Machinery.**

BOND, J. R. *The Scottish Journal of Agriculture*, Vol. VII, No. 4, pp. 357-364, plates 2. Edinburgh, 1924.

Rotary Tillage. Various attempts have been made to devise a machine which would produce a fine tilth in one operation. The application of the principle of rotary tillage or fraizer work is attributed to MECHWART of Budapest, but the machine best-known to British farmers is that of SIMAR, made in Switzerland. In the Highland Society's trials in 1922 the report on the SIMAR Rototiller was as follows : On unbroken stubble the machine pulverised the soil thoroughly to a depth of 8 inches, and left a loose mould 10 inches deep. On dirty land the surface weeds were thrown out and left clean on the surface. It was considered to be a very useful machine for autumn cleaning of dirty land, but not suitable for grassland as the turf was broken up and left on the surface.

On soil in a suitable condition the machine extracts weeds and produces an ideal seed-bed in one operation.

The Rein Drive Tractor. This machine, made by Messrs. FOWLER of Leeds, has been developed in Australia. It is a two-wheeled tractor rigidly coupled to the implement that it is required to haul. By means of the reins the driver, who is seated on the implement at the rear, can cause

the motor to advance, back, stop, or turn. It is very handy for working in confined places. The driver has both the working implement and the tractor in front of him, also, he is free from the vibration and noise of the tractor. W. S. G.

622. **Recent Developments in Oil Palm Machinery.**

EATON, B. J. *Malayan Agricultural Journal*, Vol. XII, No. 12, pp. 382-393. Kuala Lumpur, 1924.

The problem of the best type of machinery for the treatment of the oil palm fruit, involving the separation of the pericarp from the fruit and extraction of the palm oil from the pericarp, has been under consideration for some years. The author has studied the plant shown at the British Empire Exhibition and is of opinion that the problem has been solved satisfactorily.

The processes of Manlove, Alliot and Co., and Culley Expressors, Ltd., are fully described, with details and cost of plant. The essential differences between the two processes are that, in the former the whole fruit is treated direct in the centrifugal extractors after digestion with steam at low pressure, whereas in the Culley process the pericarp is first separated in a special machine, after the fruit has been heated in a digestor, with no direct contact of steam. From actual experience with palm fruits treated either with boiling water or low pressure steam, the author does not considr that decomposition of the oil is likely to result from contact with low pressure steam.

The treatment of pericarp alone in the Culley centrifugal extractors gives a larger output from these machines, since the nuts are not introduced, but an extra operation, that of depericarping, is involved, which requires a special machine. W. S. G.

RURAL ECONOMICS.

623. **The Importance of the Cultivation of Roots in the Organisation of Farming.**

MEUNZINGER (Hohenheim). Die Bedeutung des Hackfruchtbaues für die Betriebsorganisation, *Mitteilungen der D. L. G.*, XL. Year, No. 11. Berlin, March, 1925.

High cost of labour, low prices of farm products, lack of working capital and credit, are characteristic of the present condition of German agriculture. It is not surprising that many farmers, owing to the necessities of the moment, try to force their soil to yields more, even if by this expedient they damage the future prospects of their farms.

The author's object is to show that the cultivation of roots, though the cost of labour is more and the return less than more extensive crops, is yet absolutely indispensable for the general good of all the crops in the rotation and that without roots the other crops will produce less.

The author shows by means of tables the average cost of production for each crop grown on the farm of the Agricultural High-School at Hohenheim over a period of 30 years. As a unity of measure for the work done he does not employ monetary unities but "normal men-days" (Woman's work = $^3/_4$ man's day) and "normal horses'-days" (4 oxen = 3 horses).

Costs of production per ha. in men-days and horses-days.

Roots	121	50
Rape and leguminous plants	61	30
Wheat	39	20
Meadow-land	25	11

It is seen from this that roots require more labour, both from man and team and that the cost of roots is three times as high as for corn.

Labour is no doubt to-day the greatest expense in farming; after it comes manuring. Here too, roots are the most expensive of all, rape and leguminous plants occupy the second place, corn the third and meadow-land the fourth.

The author then considers the cost of the seed of the different crops, in which relation also, potatoes with a cost five times as high as that of wheat present an unfavourable result.

The costs are compared with the gross monetary returns. Over an average of 30 years at Hohenheim there were harvested; 27.3 double quintals of wheat; 27.0 double quintals of oats; 175 double quintals of potatoes; 300 double quintals of sugar beets. If the total cost is compared with the rough produce, it results that the relation of cost to gross return of money is:

Crop	Total cost	Gross return	Excess of returns over cost
Wheat	352	630	278
Oat	320	472	152
Potatoes	854	918	64
Sugar beets	836	960	124

It must be stated that the Hohenheim soils are decidedly corn soils and are not good potato soils, which makes the results somewhat unfavourable to the latter.

The data show that the cost is so high with roots that, if marketable products only are considered their gross profit remains far behind that of cereals, particularly wheat. The difference becomes still more

unfavourable, when the relation of expense to gross profit surplus is considered, for example:

Wheat.	100 : 79
Oat	100 : 48
Potatoes	100 : 8
Sugar beets	100 : 15

Hence, wheat and oats, with a *minimum* of risk and the smallest expense, yield a relatively the largest surplus. But they are only favourable — and therein lies the invaluable character of root-crops, which does not appear from the figures — when corn is grown in rotation with roots. If the influence of roots were eliminated, such high yields for wheat and oats (an average of 31.5 double quintals, relatively 33.7 double quintals in the last 12 years) could never be attained. The result would then be quite different, for without roots the soil would need such quantities of artificial manure, that it would soon be impossible to increase the yield of cereals by forced increase of artificial manuriug.

Replacing the expensive potatoes or the sugar beets by rape or leguminous plants does not have so good an effect, nor is the result so certain. Laying down a large extent of land to grass is only advisable where the soil makes such a course necessary. To change good arable land into meadow land would be short-sighted and would alter the general relation of prices, to the disadvantage of cattle production, to which the farmer who had followed this policy would turn.

In considering the unfavourable figures shown actually by roots, one must not overlook the advantages to other crops of the cultivation of roots and therefore the words of RUMKER concerning the cultivation of roots are still perfectly justified: "The cultivation of roots is the base and the lever for the introduction of a higher and more intensive cultivation of the soil, for larger yields of the land and an increased production of cattle. It is the high school of modern intense agricultural development and hence one of the most important factors of the possibility of supplying by our own production our requirements of bread and meat. Whosoever raises the axe against this point and damages this base of our existence, does us a vital injury". H. I. H.

624. **A Study of Farm Organization in Central Kansas.**

GRIMES, W. E., HODGES, J. A., NICHOLS, R. D., and TAPP, J. W. *United States Department of Agriculture Bulletin No.* 1296, pp. 74, figs. 31, tables 35. Washington, D. C., 1925.

The authors have made an intensive study of the organization and working of a number of representative farms. The information obtained forms a basis for judging the suitability of different combinations of enterprises, deciding which combinations should prove most profitable under varying market prices conditions, and indicating how efficiency in the different operations may be attained.

The area selected is described, labour and material used in crop and livestock production are discussed. The principles governing choice of farm enterprises are dealt with, and the application of those principles.

Various aspects of the problems discussed are illustrated by graphs.

W. S. G.

625. **Agricultural Valuations.**

BORDIGA O. (Professor of Rural Economy and Valuation and Agricultural Accountancy at the Royal High School of Agriculture at Portici). *Trattato di stime rurali* (Treatise on Agricultural Costings). 3rd and completely revised edition. Vol. I, p. IV +436, 1923; Vol. II, p. IV+396. E. Della Torre, Portici, 1923.

The third edition of the work of Prof. BORDIGA was eagerly awaited, as the two previous editions (1891-3 and 1907-11) were out of print. It is distinguished by: the bringing up to date of the information given, in which full account has been taken of the economic phenomena which began after the war and of recent legislation on the subject in Italy, accompanied by figures and methods of valuing; by the more extended information preparatory not only to the making of valuations, but also to the investigation of farm management as applied to the most extended form of agriculture; by the concise but complete description of the economic-agricultural conditions of the various regions of Italy, of which half a century's teaching and professional experience has given the author a profound knowledge, enabling him to indicate the sources of all the information supplied under this headings.

After some chapters treating of the history of Valuation and its general principles, the author, in Vol. I, deals with: Agricultural, agricultural-industrial and livestock products; market prices; the yield and cost of human, animal and machine labour; farm management. Vol. II: Methods of making valuations, valuation of land with a view chiefly to purchase and sale. Methods of valuing landed estate; valuations in various public and private interests; valuations of land under permanent cultivation; forest valuation; estimations regarding water, improvement of land, damage caused by hail, fire, industrial contaminations, etc.

Each volume concludes with an alphabetical analytical index and a numerical index.

The work is especially intended for surveyors and valuers, those holding degrees in agricultural science, civil engineers and scientific agriculturists, teachers of agriculture and valuation, students of economic-agricultural management, proprietors, and managers of country estates.

F. D.

626. **The Profit Yielding Capacity of Farms with Regard to Recent Valuation for Income Tax of Agricultural Properties, Large, Average Sized and Small.**

ROTKEGEL W. Die Rentabilität der landwirtschaftlichen Betriebe mit Rücksich auf die jüngste Einschätzung der landwirtschaftlichen Gross,

Mittel und Kleinbetriebe zur Vermögensteuer. *Jahrbücher für Nationalökonomie und Statistik*, Vol. 122, No. 5, pp. 634-639. Jena, 1924.

In the article the author emphasizes the fact that the valuation of agricultural holdings according to the returns only, cannot be considered as sufficient, the size of the holding has also an important bearing on the net return. He shows that the net return per unit of area of equal quality may be much higher with a small holding than with a large. This is already cleat from the fact observed when land is bought or rented, viz. that the price per hectare of a small holding is much higher than that of a larger one.

When it is remembered that the self supporting agricultural holdings of large or average size predominate everywhere with the leading civilised nations, it is clear that it is not enough to estimate the yield of holdings without taking account of their category. A great difference of opinion however exists as to the size which is economically the most advisable. AEREBOE has summed up the essential point of the question in the following remark quoted from his " Allgemeine landwirtschaftliche Betriebslehre " : " From a point of view of the advantage of the individual there is no such thing as an absolute superiority of large, average-sized or small property. This superiority on the contrary varies in each case according to market conditions and according to natural and particularly personal circumstances ". H. J. H.

627. **The Cost of Production of the Sugar Beet in Hungary.**

PRACK, L. (Landesinstitut für landw. Betriebslehre, Budapest). *Wiener landwirtschaftliche Zeitung*, Year 75, No. 6054. Vienna, 1925.

The author gives an account of the change in the working conditions in connection with the cultivation of sugar beets during the post-war period and shews by means of a table the increase of the cost of production for each item of working expenses, to which corresponds a fall in the prices given for the crop produced.

The total cost of production for sugar beets before and after the war is shewn by the following table :

Cost of production per " Kadastral yoke " (1).

	Before the war			In 1924		
Yeld of beets (taken as)	100	150	200	100	150	205
In current money	2.08	1.42	1.50	49200	25226	25290
In gold values	2.08	1.42	1.10	2.90	1.95	1.48

Before the war the average price obtained for the sugar beet was 2.20 Austrian crowns, so that production would pay, even with a gross

(1) A " Cadastral yoke " = 0.57 546 ha.

yield represented by 100. Nowadays the Hungarian factories pay only 30,000-32,000 Hungarian crowns, at which price only the highest yields are remunerative.

H. J. H.

628. **Transport in Tropical Africa.**

BRACKENBURY, R. H. *Journal of the Royal Society of Arts*, Vol. LXXXIII, No. 3776, pp. 464-486. London, 1925.

Transport in tropical Africa is largely a question of how to bring agricultural and other raw produce from the interior down to the coast for shipment, and on the other hand, how to send manufactured goods to the interior. The problems depends upon the cost per ton-mile, and the author shows that there is a vital gap to be bridged between the potential producer of the world's foodstuffs and raw materials in Tropical Africa, and the arterial lines of the world's communications. The gap comes between the primitive native methods and the highly specialised railway systems. The cost of railway transport per ton-mile decreases as the quantity carried increases, whereas with primitive methods of transport the contrary is the case: as quantities increase, so also the cost per unit increases.

A railway cannot be constructed to carry small quantities of produce economically. At present in many parts of Africa there are only two alternatives — porters to carry a few tons, or a railway to carry thousands of tons. It requires about 40 men to carry one ton of produce, and to transport 100 tons per month over a distance of 100 miles will need 2000 men. Apart from economic objections, such numbers of carriers are not available. To carry 1000 tons per month from a point far inland, by men, packs-donkeys, camels or even ox-wagons is not practicable. On the other hand, it would be a doubtful venture to build a railway for such a quantity.

Light railways in Africa can hardly be built for less than £5000 per mile; the cost of the railways of Nigeria is given as £11 000 per mile.

Pack transport, or wagons, are more efficient than men as carriers, but over very large areas the use of animals is excluded by the presence of the tsetse fly. Hence, the solution of the problem cannot be found in head porters, pack animals, or ox, or mule wagons.

Another suggestion is that of macadamized roads for heavy motor wheeled traffic, but the tropical vegetation and torrential rains make the maintenance of such roads over great distances, impracticable.

The author advises that unmade roads should be cut, radiating from railway stations, and that large sums of money should be spent only on building substantial bridges and drains.

With reference to motor traffic, the various types are dicused, such as the ordinary, solid type lorry, the six-wheeled Albion lorry, the Renault six twin-wheel car, etc. The caterpillar-track type is then treated, such as the Diplock Pedrail, the Guy Lorry, now being tested by the Empire Cotton Growing Cooperation, the Sentinel Roadless Tractor, and the Citroën Kegresse.

In the opinion of the author, it is by the use of these track vehicles that the « economic gap » will be bridged in the transport systems of Tropical Africa, as that type of motor alone is adapted for carrying seavy loads over unmade roads.

The solution of this problem is of vital interest with regard to the development of agriculture in all tropical countries. W. S. G.

AGRICULTURAL INDUSTRIES.

Plant Products.

629. **Cold Concentration of Vegetable Solutions and new Applications of Refrigerator Plant in Enology.**

MONTI, E. *Report of the III National Congress on Refrigeration*, pp. 1-16, 1 plate. Milan, 1924.

For the concentration of solutions, especially if they are very liable to change (as regards delicate aromas for instance), the author uses the condenser and mechanism of a refrigerating machine, which by utilising the machine to the utmost enables him to attain his object. In the States this apparatus is used in the establishment at Ukiah (California) in the preparation of grape extract, the yield being 40-43 kg. of water separated for every kg. of heavy oil burnt in the motor.

The method may be applied in other ways, for instance, it is possible not only to preserve, but also to improve, or rather intensify, the aroma. This may be done in the case of the tomato in the preparation of the concentrated liquid.

Refrigeration may be extensively applied in enology, as it serves to stabilize wines and liqueurs, for which purpose however it is also necessary to oxidise previously all substances capable of being so treated which are contained in them. The process also serves to artificially age wines, in which it leaves, even in an improved state, the whole bouquet.

By this means also an extract of the bouquet of the wine may be prepared from the grape residues, which extract also contains the colouring matter, enzymes and vitamines. The process may be applied in numerous ways, either for a more scientific preparation of wines with a low degree of alcohol, which retain their colour and bouquet, or for the better utilisation of the residues, or again for intensifying the flavour and aroma of fruits in general. A. F.

[629]

636. **Dried Beet Slices and Beet Flour.**

HOC. P. Les cosettes séchées et la farine de betterave. *Journal d'agriculture pratique.* Vol. 1, No. 9, pp. 170-173. Paris, 1925.

The beet, transformed into dried, unalterable slices, forms a very concentrated, easily transportable feed, and one which is easily assimillable and keeps well. The dried slice is especially rich in sugar, which it yields at the lowest possible price and in the form most appreciated by livestock.

Average composition of dried slices.

Water	13.80 %	Carbohydrates	8.66 %
Sugar	59.40 %	Cellulose	4.99 %
Nitrogenous matter	6.95 %	Ash	5.81 %
Fats	1.65 %		

Horses fed on dried beet slices instead of oats, 3 kg. of dried beet slices replacing 5 kg. of oats, retained their vigour, doing the same amount of work and increasing in weight.

In practice the slices should be substituted gradually, litre per litre, that of the beet slices weighing 300 gm. as against that of oats weighing more than 500 gm.

The dried beet slice is also equally suitable for working oxen and store cattle. For working oxen, hay, beets and cake have been successfully replaced progressively by 7 kg. of beet slices, plus 3 kg. of bran. It is well however to utilise the slices as a supplementary feed in quantities of 600 gm. for store cattle per 100 kg. of live weight. Beet slices used as a pig feed give excellent results: live weight increases very rapidly and the meat is superior in whiteness and flavour.

The pigs are very fond of the slices and consume them without the least hesitation during the whole period of fattening. For store sheep, the beet slice is a perfect feed, bringing them to the desired point of fattening and imparting an agreable flavour to the meat.

Given in moderate quantities the beet slice has a good influence on lactation and the milk's richness in fat content.

Beet slices prove superior and more economic in use than the other feeds sweetened or treated with molasses.

% Composition of beet flour.

Albuminoids	6.00 %	Fat	0.75
Saccharose	65.50	Water	6.40
Carbohydrates	12.75	Residues, saline, inert matters	3.40
Saccharifiable cellulose	5.20		

The beet slices are placed on a tray and treated with steam mixed with unsaturated hot air; the heat coagulates the albuminoid substances of the protoplasm, the cells allow the water they contain to evaporate, and on the next trays they are subjected to a strong current of air, less and less charged with steam and of increasing heat.

Sugar beet meal may be mixed with groundnut cake, cotton, coconut and linseed cake, which are too poor in carbohydrates in proportion to their nitrogen content, of which it increases the sugar content, rendering them more digestible.

The meal will keep for an indefinite period without alteration.

A ton of beets gives 250 kg. of meal. P. D.

631. **The Physiology of Apples as related to Storage.**

I. — HAYNES, D. (Department of Plant Physiology ant Pathology, Imperial College of Science and Technology, London). Chemical Studies in the Physiology of Apples. Change in the Acid Content of Stored Apples and its Physiological Significance. *Annals of Botany*, Vol. XXXIX, No. CLIII, pp. 77-96, figs. 8. London 1926.

II. — ARCHBOLD H. K. The Nitrogen Content of Stored Apples. *Ibidem*, pp. 97-107, figs. 2.

III. — *Idem*. The estimation of Dry Weight and Amount of Cell Wall Material in Apples. *Ibidem*, pp. 109-121, figs. 3.

The different varieties of apples contain varying quantities of acid, from a minimum of 0.15 %, calculated as malic acid, for the « Sweet Alford » variety, to a maximum of 1.5 % in the « Bramley's Seedling ». In spite of these considerable initial differences, after having been stored for a certain time all the apples have very nearly the same acidity, which is rarely more than N/50. There is no doubt that such changes, accompanied by changes in hydrogen-ion concentration, influence metabolism and are an index of those processes of breakdown which come under the name of senescence.

The effects of storing at low temperature are a decrease of the rate of loss of acid and an increase in the fluctuation of the acid content. The loss of acidity follows a course which may be expressed by a logarithmic law, expressed by the formula : $\log. C = b\text{-}at$, in which C is the acid concentration in mg. per 100 cc., b the logarithmic value of the acidity titration at the date of picking and a measures the rate at which the acidity declines.

Deviations appear to arise from immaturity, when the apple is picked too early, and to internal breakdown during cold storage. If, on the other hand, the apples are stored at 15° instead of 1°, the actual curve very closely follows the logarithmic law ; as a matter of fact, then, the loss of acid is much greater than it seems to be, since, at a higher temperature, there is a loss of water through evaporation (which is quite negligible at 1°), hence there is a greater acid concentration.

In cold storage there is, in general, a direct relation between high acidity and internal breakdown, so that the latter may be avoided by exposing the apples to low temperatures only when the acid content has been reduced. On the contrary the higher the acid content at the time of picking and the slower the loss of acidity, the more favourable are the conditions for internal breakdown.

The physiological breakdown is accelerated by a low temperature under conditions which maintain a high acidity, at the same time retarding the breakdown of the cell-walls, so that storage at a low temperature would bring about conditions for a premature internal breakdown.

The course followed by the process of disintegration of the cell-walls is probably determined by the hydrogen-ion concentration ; it is therefore well to titrate the juice 2-3 times during the first weeks of storage. The logarithmic curve thus obtained shows the time required to arrive at a given acidity concentration, of which the minimum compatible with a satisfactory state of the apple is 10 mg. per 100 cc. in the " Bramley's Seedling " variety. A disposition towards rapid breakdown is also shown by an abnormal course of the curve, combined with high acidity.

During storage at a temperature of 1-3°, there is a decrease in the nitrogen content of the apple, and as it contains no substances which indicate protein degradation, it must be concluded that the protein undergoes oxidisation, this leading to the formation of nitrites or nitrates. The apple contains nitrogen in the form of protein, of which only traces are soluble; the quantity of nitrogen is 0.02-0.08 %.

A correlation is observed between nitrogen content, acidity and the degree of respiration of individual apples, inas much as a high nitrogen content is related to low acidity and high respiration.

As regards the weight of dry matter, the author observed that it remains appreciably constant at 1°, whereas it diminishes when the apple is kept at a temperature of 3°. The effect of the low temperature is either to slacken the speed of chemical reactions or, especially, to alter their nature.

A. F.

632. **Problems of Apple Transport Overseas.**

KIDD, Dr. F. and WEST, Dr. C. *South African Journal of Industries*, Vol. VIII, No. 3, pp. 193-201. Pretoria 1925.

The article embodies the chief points of the special Report (No. 20), drawn up by the authors, of the Food Investigation Board of the British Department of Scientific and Industrial Research, and contains the results obtained by the scientific expedition sent to Australia in 1923.

The Australian apple export season of 1922 was a record, but of a total of 2,000,000 cases, over 500,000 arrived in England in a severely damaged condition, the loss caused by damaged fruit being estimated at £250000 for the whole season ; these losses were largely due to brown heart.

The problem of ventilation. It had already been found that English apples would develop brown heart on cold storage, under conditions such as would allow an accumulation of the carbon dioxide produced by the apples by the process of respiration. The knowledge was utilized and ventilation methods were adopted in ships in 1923, with the result that brown heart occurred in two cases only of that season's shipments.

Investigations respecting the occurrence of brown heart before shipment gave negative results. It was proved by experiment that apples subjected to insufficient ventilation in transit will develop brown heart,

and that removal of those conditions will avoid all danger of the disease developing during a voyage.

The amount of ventilation necessary depends upon the rate of carbon dioxide formation in the ships' holds, and this depends mainly upon: the weight of apples present; the inherent respirating activity of the apples; the temperature of the apples. The amount of carbon dioxide likely to be formed per ton per day is only about 2.5 cu. feet, at a temperature of 35° F.; with 1 % carbon dioxide in the hold the amount of ventilation must be sufficient to remove about 250 cu. feet of air per day per ton of apples.

Accidental ventilation often occurs, and this has been responsible for the safe carriage of cargoes in the past where no intentional ventilation had been given.

The problem of temperature control: The length of life of apples in cold storage is prolonged by a reduction of temperature, due to two cases: (1) a redardation of ripening; (2) the checking of mould development.

The best conditions as regards temperature are: cooling the fruit to 32° F.-34° F. with the least possible delay after gathering, and the maintenance of a uniform temperature of 30° F.-34° F. throughout the voyage.

The difficulties increase in proportion to the bulk of cargo carried and the size of the hold.

The results obtained by the expedition show that in large holds none of the systems in use attain a uniform temperature throughout the cargo after cooling.

W. S. G.

633. **Marketing and Distribution of American-Grown Bermuda Onions.**

STEVENS, W. M. *United States Department of Agriculture, Bulletin,* No. 1283, pp. 55, figs. 14, tables 11. Washington, D. C., 1925.

The author discusses the extent of the onion industry, the producing areas, varieties, production, distribution, methods of sale, transport charges, market prices during 1916-1923, factors influencing prices, and con, cludes with the official description of the United States Grades for Bermuda onions, with descriptions of the grade terms.

W. S. G.

634. **The Vitamine Content of Fungi.**

STEIDLE, H. (Pharmakologisches Institut der Univers. Würzburg). Besitzen essbare Pilze antiskorbutische Wirkung? *Biochemische Zeitschrift,* Vol. CLI, Nos 3-4, pp. 181-186, figs. 2. Berlin, 1924.

Contrary to what has been asserted by other authors, the edible fungi *Cantharellus cibarius* and *Psalliota campestris* do not contain the antiscorbutic vitamine C. The tests were made on fresh fungi.

A. F.

635. British Guiana Woods for Paper Making.

Bulletin of the Imperial Institute, Vol. XXII, No. 1, pp. 14-28. London, 1924.

The thirteen specimens of the timber and palm stems the report of which forms the subject of the article were sent to the Imperial Institute, London, for examination as to the value for the manufacture of paper pulp.

Details of each wood are given in the article; the results obtained are summarised in the following table:

Local Name	Botanical Identity	Parts of caustic soda consumed per 100 parts of material containing 12 % moisture.	Yield of dry unbleached pulp expressed on material containing 12 % moisture.
		%	%
1) Bara-bara	*Diospyros guianensis*, Gürke (Ebenaidae)	14.3	48
2) Baramalli	*Tubebuia* sp.? (Bignoniaceae)	13.1	42
3) Fotui	*Jacaranda Copaia*, D. Don. (Bignoniaceae)	11.3	53
4) Haiari-balli . . .	Leguminosae)	11.4	45
5) Hubu (Hog Plum)	*Spondias lutea*, Linn. (Anacardiaceae	15.3	41
6) Hurowassa . . .	*Pithecolobium trapezifolium* Benth. (Leguminoseae). .	12.5	42
7) Karahora	*Schefflera depressa*, Sprague, n. sp. (Araliaceae)	12.0	51
8) Kurukoruru . . .	*Diplotropis* sp.? (Leguminoseae)	11.9	43
9) Long John . . .	*Triplaria surinamensis*, Cham. (Polygonaceae)	13.9	40
10) Wanasoro	*Cecropia Juranyana*, Richter (Moraceae)	14.3	40
11) Manicole	*Euterpe edulis*, Mart. (Palmae)	15.1	40
12) Ite (Aeta). . . .	*Mauritia flexuosa*, Linn. (Paluiae)	12.8	28
13) Mukka-mukka . .	*Montrichardia arborescens*, Schott (Araheae).	14.6	30

From these results it is seen that the first ten woods, give on the whole good yields of paper pulp. The pulps bleached satisfactorily and could be used, in most cases, for the manufacture of paper of good quality. Wood No. 11 (Manicole) is less valuable and the last two would not be worth exploitation owing to the low yields of pulp given. Ite also gave a paper of inferior quality.

W. S. G.

636. **Investigations of Paper Making Materials.**

Bulletin of the Imperial Institute, Vol. XXII, No. 4, pp. 418-433. London, 1924.

In the article is given an account of the results of examination of materials sent recently to the Imperial Institute, London, in order to ascertain their suitability far paper-making.

Bamboo from Mauritius. This is a small variety of bamboo, thought to be *Bambusa nana*; the yield from an experimental area was about 20 tons of stems per acre. The pulp produced was equal in quality to that of *Bambusa Tulda*, but the yield was somewhat lower.

Elephant Grass from Sierra Leone. The material consisted of stout grass stems which yielded a readily bleachable pulp, producing a strong paper of good quality

Bardy Reed from Iraq. The pulp did not bleach well and is not a promising paper-making material.

Costus afer from Uganda. The investigation showed that the yield of pulp from *Costus afer* is satisfactory, being similar to that of esparto grass. The pulp felts well and gives a good quality paper, bleaches well and then yields a strong white paper suitable for writing and printing papers.

Amomum Granum-Paradisi from Uganda. Closely related to *Costus afer*, produced a pulp that bleached with some difficulty and yielded a hard, though, " rattly " paper, suitable for writing and printing papers.

Abutilon tortuosum from South Africa requires a high consumption of soda and gives a low-yield of pulp, but felts well and produces a good quality paper.

Waste Cotton Bells from Egypt. The original material yields a pulp which can be made into brown wrapping paper, or after bleaching can be used for producing cream-coloured paper. The opinion expressed was that this material could not be used for export unless clean, white cotton could be obtained from it. An engineer stated that it would be very difficult to devise a machine to extract clean lint from the bolls, and that it could be used profitably only in Egypt for the manufacture of brown wrapping paper.

Arrowroot refuse from St. Vincent. The investigations showed that this material has a low-value for paper-making. W. S. G.

637. **The Diagnosis of Decay in Wood.**

HUBERT, E. E. *Journal of Agricultural Research*, Vol. XXIX, No. 11, pp. 523-567, plates 11, figs. 6, tables 5, bibliography. Washington, D. C., 1924.

Many of the industrial problems connected with the staining and rotting of wood could be more satisfactorily dealt with if a reliable means were available for the identification of the fungi which cause decay in wood and wood products.

The author has made an exhaustive study of the subject and in the

article describes methods for the diagnosis of decays commonly found in wood, together with notes on a number of wood-destroying fungi of economic importance.

A classification under two main groups of white rots and brown rots is given, according to gross characters.

The methods for diagnosis are given under three main divisions: gross, microscopical, and cultural characters. These when determined are considered to supply sufficient data for identification of the causal organism.

A complete diagnosis will decide whether or not decay is present and whether the causal organism is alive or dead, and will give data as to the fungus.

The use of the diagnostic methods described will supply data of scientific value for the solution of problems relating to the staining and rotting of wood. W. S. G.

Animal Products.

638. **The Gerber Method for Determination of Fat in Milk.**

ANDERSEN, A. C. et WINTHER J, E. Om Gerbers Metode til bestemmelse af feat in moelk. — 116. *de Beretning fra Forsøgslaboratoriet*, udgivet af den kgl. Veterinaer-og Landbohojskoles Laboratorium for landøkonomiske Forsøg, p. l. 66, 6 tables, 1 fig., Copenhagen, 1924, (received 1925).

In the 115th report from the Experimental Laboratory was mentioned the application of the Gerber-van Gulik's method for determining fat in cheese, and also examinations, which showed that the percentage of fat found was less in conformity with the analysis by weight as the cheeses decreased in quality. These results have now led to the re-testing of the *Gerber acidbutyrometrical method* itself, and it is these very thorough examinations which are mentioned in the 116th report and from which the following chief points are reproduced:

1. *The classification, etc. of the butyrometers.* A statement is given of the cubic content of the butyrometers, and of the chief results these may be quoted: " It is taken for granted that the butyrometers are classified on the supposition that all fat present in the milk is freed and that it is freed in pure state. Though this last mentioned supposition may not be perfectly correct, the alterations taking place in the milk fat by the Gerber process are of so little importance that they do not influence the result ".

2. *Determination of Fat in Milk.* — The chief principle of the Gerber method is that the protein matters of the milk are decomposed by means of strong sulphuric acid; this process disengages the fat which, after the addition of amyl alcohol, combine on being treated in a centrifugal consisting of a divided tube in which its volume and hence its quantity is shown. 10 cc. of sulphuric acid, 11 cc. of milk and finally 1 cc. of amyl alcohol are measured. The measuring must always take place in the order: sulphuric acid, milk, amyl alcohol. The milk must be slowly run out of the pipette and down the wall of the butyrometer, so that it may form a

layer over the sulphuric acid. The milk from which the 11 cc. is taken must be well mixed.

3.— *Exactitude in the determination of fat in whole milk.*— The investigations proved that, by careful manipulation in determining fat in whole milk by means of Gerber's method, results may be obtained which on an average in 72 % of all cases deviate no more than 0.05 % fat, and on an average in 95 % of all cases no more than 0.1 % from that found by the actual laboratory method (Rose-Gottlieb's method).

4. *The influence of various factors on the exactitude.*

a) The strength and quantity of sulphuric acid. — The directions say that its specific gravity must be 1.820-1.825 at 15°C, corresponding with a content of 91 % of pure sulphuric anhydride. By the experiments, sulphuric acid with a specific gravity of 1.825, 1.80, 1.75 and 1.70 has now been tested, the three first mentioned giving the same results; by the application of acid with a specific gravity of 1.75 there was coagulation which complicated the reading. Acid with a specific gravity of 1.70 could not be used as the casein did not dissolve, nor was the fat clearly freed. It is essential that the sulphuric acid should be protected against absorption of water, which may easily be prevented by taking care that the bottle is never left without a stopper, which must be of glass or rubber, the former by preference.

b) Amyl alcohol.— Gerber states that this must have a specific gravity of 0.815 at 15°C. and distil between 128 and 130° C. The investigations showed that the amyl alcohol may deviate considerably from the demands made by Gerber as to specific gravity and boiling point, and still be perfectly suitable. In controlling its efficiency the chief points therefore must be the results of comparative determinings of fat, not the physical character of the alcohol. An alcohol that will disengage drops of oil in the blank experiment made with water instead of milk, as suggested by Gerber (described in the report) is useless.

c) The temperature and duration of the water-bath. — Gerber states that the prepared samples must never be left for more than fifteen minutes at 60-70° C. before they are treated in the centrifugal machine, as otherwise "stoppers" may easily appear where the sulphuric acid and the fat column meet, which statement was confirmed by the experiments. After having been treated in the centrifugal machine the samples must be placed in the water-bath to be heated to 65° C. before the reading can take place, the scale in the tube being intended for fat at this temperature. Experiment showed that the samples are able to stand for a longer period at that temperature without any bad effects being visible; an alteration of 1°C. in the temperature while standing, for each cc. gives an alteration of only 0.0008 cc. or 0.08 % of the quantity of fat, which means that in milk with 5 % fat an error of 12.5° in the reading of the temperature will only give an error in the reading of 0.05 % fat.

d) The state of ths milk samples. — Neither the addition to the milk sample of formalin nor potassium dicromate will prevent certain milk, after standing rather a long time, undergoing alteration, *i.e.*, some part of the milk decomposes. Experiments showed that the Gerber method

[638]

may give correct results even though the fat is partly decomposed. By the examinations of poor milk, the fat of which was partly decomposed the method in most cases gave too low results.

e) The fat percentage of the milk samples. -- The experiments proved that while the Gerber method, when applied on ordinary whole milk, gives fair results, it gives generally, when applied on very high percentages of fat, somewhat too high results; with very low percentages of fat the results are ordinarily a good deal too low if the special method is not applied, and even with the butyrometers, which are specially constructed for very poor milk, the average result is a little too low.

On the whole, however, it may be said, as already mentioned in the 61st report from the Laboratory, that when a carefully treated Gerber sample can be read with certainty, the results will always be sufficiently accurate for practical requirements.

The determination of fat in cheese by the Gerber-van Gulik method. (Butyrometer for 15-20 %fat). — As already mentioned, it appeared that after the introduction of the cheese control at the Experimental Laboratory that the fat percentages found by the Gerber-van Gulik method generally are less accurate, as compared with the analysis by weight, as the cheeses become poorer in quality. The reason must be sought in the fact that the cheese fat, unlike the milk fat, is nearly always somewhat acid; the free fatty acids combine with the amyl alcohol to form sal alcyl which has a fruity smell and is flung out by the centrifugal machine together with the fat, not entirely, however, to the same degree. Irrespective of the fat percentage in the tested sample, there will always be the same quantity of sulphuric acid in the butyrometers; the quantity of amyl alcohol-fatty acid combination which is able to remain dissolved in the sulphuric acid, therefore, under all conditions is the same, and expressed as a percentage of the fat is greater, the smaller the quantity of milk. It is therfore to be expected that for the same degree of decomposition of the fat, the probability of obtaining low percentages will increase with the decreasing percentage of fat. By working with various milk samples in which the percentage of milk, as well as the degree of decomposition, were different, it is found that the Gerber method, compared with the Schmid-Bonzynski-Ratzlaff method for milk with less than 2.5 % fat, gave too low results, the results being lower as the milk became more decomposed; this was still more evident in milk with less than 1 % fat. (Corr. Denmark).

639. Additional Information on the Influence of Foot-and-Mouth Disease on Milk and especially on Production.

PROKS, J. (Institut lactologique de l'Ecole polytechnique de Prague). Contribution à la connaissance de l'influence de la Fiévre aphteuse sur la formation du lait, surtout de la matière grasse. *Le Lait*, Year 4, Vol. IV, No. 40, pp. 830-840, 5 figs. Lyons, 1924 (received 1925).

The samples of milk analysed were taken from sick cows in different parts of Bohemia; one sample came from Central Moravia. In certain

cases the disease was not serious, in others it had reached an acute stage. The object of the analyses was to determine the total dry solids, fat, lactose, total nitrogenous matter, and ash.

The rest of the milk, after total analysis, furnished cream from which butter was made in order that the quality of the milk fats could be estimated. The following values were determined: refraction, REICHERT-MEISSL, WAUTERS POLENSKE, saponification, iodine and finally the SAVINI or corrected acetic.

In every case the results were controlled by repeating the same determinations on milk from the same animals when cured. The following conclusions may be drawn from the results of these determinations:

(1) During milk formation, the influence of foot-and-mouth disease may show itself by such changes that the quantity of undetermined constituent, expressed, in the complete analysis of the milk by the difference between the total dry solids found and the total of the principal constituents, is greatly exaggerated; in other words, the samples of milk show a comparatively large difference between the total dry matter and the sum of the principal constituents.

(2) The index of refraction of the fats rises.

(3) The REICHERT-MEISSL index is much lower than for the fats in normal milk, which indicates a comparatively low percentage of soluble volatile acids.

(4) The WAUTERS POLENSKE index is often very high, indicating an abnormally high insoluble volatile acid content.

(5) The saponification index is somewhat lower, this reduction corresponding with that of the REICHERT-MEISSL index, but in every case it remains within normal limits.

(6) The iodine index was remarkably high, indicating that the fats in the milk of cows attacked by foot-and-mouth disease have a very high non-saturated acid content.

(7) The SAVINI or corrected acetic index was found to be very high, indicating that the solubility of the milk fats in acetic acid decreases.

To summarize: butter made from the milk of cows attacked by foot-and-mouth disease may be thought to be adulterated by the addition of coconut oil, judging from the REICHERT-MEISSL and WAUTERS POLENSKE numbers; it differs, however, from butter thus adulterated in its refraction, iodine and SAVINI numbers. P. D.

640. **The Contamination of Water used in the Milk Industry and its Sterilisation by Ozone.**

SALMON (Inspecteur départemental d'hygiene des Deux-Sèvres). La contamination des eaux utilisées dans l'industrie laitière et leur stérilisation par l'ozone. *Le Lait*, Year 4, Vol. IV, No. 40, pp. 848-855. Lyons, 1924 (received in 1925).

In the milk industry it is well to use for the washing of butter and cleansing of apparatus only water possessing the physical, chemical and bacteriological characters of the best drinking water. As regards bac-

teria, the number of organisms, even liquefying bacteria, contained in water does not much matter; the nature of the bacteria and the relative proportions of some of them are of more importance: the presence of *Bacterium coli, Bacillus lactis aerogenes, Bacillus pyocyanicus, Bacillus proteus* or *enterococcus,* is a sure sign that the water is contaminated.

Among the species indicating certain contamination, there are some which, incorporated into butter, give it an ill flavour or hasten rancidity: *Micrococcus prodigiosus, Bacillus fluorescens liquefaciens, Bacterium coli, Bacillus aerogenes.* The waters used, even those found to be of good quality, should constantly be controlled by periodical bacteriological analyses.

The author examines in detail the question of residuary waters in the dairy, and observes that their being poured away on an unsuitable waste ground or especially down an absorbent cesspool, is one of the most frequent and serious causes of the contamination of waters used in the dairy.

It is therefore well to sterilise the water before use. Sterilisation with ozone is advisable, for it is effective, practical, economical, does not introduce any foreign matter into the water and modifies neither its chemical composition nor organoleptic characters.

The author describes an apparatus for sterilising water with ozone. This apparatus comprises:

(*a*) an ozone producer or tubular ozoniser,

(*b*) a system for circulating ozonised air,

(*c*) a steriliser in which the ozonised air is brought into contact with the water to be sterilised.

To ensure effective sterilisation, a sample of the water is taken as it issues from the steriliser and a starch potassium iodide reagent is added to it. If the sterilisation is good the water immediately gives a more or less intense blue colouring. Sterilisation with ozone is the most hygienic and the surest method.

Butter washed with water properly treated with ozone keeps its natural flavour and its rancidity is considerably delayed.

As to the cost, the author estimates that for a dairy treating 15 000 litres of milk per day, the use of an apparatus for sterilising the water with ozone only requires half a kilowatt of electricity per day. P. D.

641. **Influence of Pasteurisation on the Digestibility of the Albuminoid and Mineral Constituents of Milk.**

TERROIN, E. F. and SPLINDER, H. — Influence des divers procédés de pasteurisation par chauffage sur la digestibilité des constituants albuminoïdes et mineraux du lait. *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences,* Vol. 180, No. 11, pp. 868-870. Paris, 1925.

The authors administered to the same animal, a young pig of 8-10 kg., in successive periods of 7 days, cow's milk fresh or subjected at one time to pasteurisation at a low temperature (heating to 63°C for 25 minutes, stirring mechanically, then cooling), and at another time to pasteurisa-

tion at a high temperature by the STASSANO process (heating to 95° for one or two minutes continuously, then cooling).

The exact daily determination of the volume of milk taken and the weight of faeces, and the total nitrogen and ash content of the milk and faeces, enable the coefficient of digestibility to be determined.

The values found by this test lead one to conclude that none of the processes of pasteurisation by heating, which were examined, in any way modifies the digestive utilisation of the protein matter and ash.

A comparison of the results of the test with those previously obtained on other species, clearly shows the complete absence of any specific intervention of the origin of the milk in the utilisation of the protein substances of milk, and an inferiority in the absorption of the ash of cow's milk, slight in the case of the young pig, rather high in that of man.

P. D.

PLANT DISEASES.

Plant parasites.

642. **Dust Treatment for Control of Oat Smut (*Ustilago Avenae* and *U. Levis*).**

THOMAS ROY, C. *Science*, n. ser., Vol. LXI, No. 1567, pp. 47-48. Lancaster, Pa., 1925.

In the investigations on the control of oat smut (*Ustilago Avenae* and *U. levis*), dust treatment tests in the past have given variable results. While mixtures containing copper and nickel, in the form of dust, have almost always greatly reduced smut, their anticryptogamic efficacy has not always proved such as to warrant the general use of dust treatments.

The result of three years' tests in Ohio is that neither compounds of copper nor those of nickel, used alone or as dust, are sufficient to control oat smut. On the other hand in combination with corrosive sublimate, the mixture proved to possess an anticryptogamic value which compares very favourably with formaldehyde.

In treating the seed it is not only desirable that the fungicide used prove effective against smut, but also that seed germination be stimulated or, at least, not weakened. By the use of compounds of copper or nickel (carbonate, sulphate and acetate of copper, and carbonate of nickel) combined with corrosive sublimate, the seed germination was stimulated to a marked degree, which is not the case with the formaldehyde treatment.

[642]

In the preliminary tests, one part of the salts of copper or nickel and two (by weight) of corrosive sublimate were well mixed and powdered. Three ounces of the mixture per bushel of seed were used. Corrosive sublimate used alone proved to possess but very slight adhesive properties; moreover, owing to its relatively high cost and extreme toxicity it would be less readily used alone than with some other compound which might serve as a vehicle. The fundamental idea is to add to the salts of copper or nickel, just enough corrosive sublimate to raise the anticryptogamic power of the mixture to the required degree for the control of oat smut. Further experiments are necessary in order to ascertain more accurately the minimum quantity of the salts which may be effectively used, bearing in mind also the reduction in cost. G. T.

643. *Bacillus Phytophthorus*, the Cause of "Potato Blackleg" disseminated by the *Phorbia fuscipennis* Dipteron in Minnesota.

LEACH J. G. The Seed Corn Maggot and Potato Blackleg. *Science*, n. ser., Vol. LXI, N_0 1570, p. 120. Lancaster, Pa. 1925.

It has hitherto been generally considered that the tubers from infected seed are the sole cause of infection by, and the dissemination of, the so-called potato blackleg, a disease caused by *Bacillus phytophthorus* Appel. Also that all the tests have shown that the pathogenic agent does not winter in the soil; it has also been thought that it winters only in the partially decomposed tubers.

The author's recent observations have led to the conclusion that the Dipteron, *Phorbia fuscipennis* Zett ("seed-corn maggot"), largely diffused in the United States of America and known to be injurious to a large number of crops, is a common agent of the dissemination and inocolation of blackleg in Minnesota. Preliminary tests also show that the pathogenic agent may be biologically transmitted by the insect, which affords another important means of wintering.

The eggs of the Dipteron are deposited on tubers before they are planted. It has been shown that the eggs may be contaminated by the bacteria when they are deposited. The larvae of the insect have been found in a very large percentage of fragments of tubers under diseased plants, whereas they have never been observed in sets of tubers from which plants not attacked by blackleg have sprung. The larvae abandon the decomposed fragments and, entering the soil, change into chrysalises before or a little after the symptons of the disease begin to appear on the shoots of the host plant. This probably explains why they have not been observed more frequently.

The larvae of the Dipteron act as agents of inoculation by boring galleries in the fragments of tuber, introducing the bacteria therein and at the same time favouring the development of the disease by inhibiting the normal tendency of the segment of tuber to develop a cork-like stratum which prevents decomposition. In tests made over a period of more than three years, more than 500 segments of tuber, partially decomposed by *Bac. phytophthorus*, were planted in both moist and dry soils. All

the segments, with the exception of a few which decomposed completely before the germs could develop, remained immune from the decomposition caused by the bacteria, and gave rise to healthy plants. The tubers were treated in such a way that the Dipteron could not come into contact with them before planting; no larvae were found in the segments. On the other hand, when nine segments immune from the bacteria, and each bearing one or more eggs of the Dipteron were planted, two cases of blackleg developed. In the segments of tuber from which the two diseased plants sprang were found larvae of the Dipteron, but this was not so in the other seven. The greater part of the eggs used in the test were of unknown age and therefore of doubtful vitality. If all the eggs had been deposited a short time before, most probably a larger number of plants attacked by blackleg would have been obtained.

In numerous cases examined by the author, in which a high percentage of blackleg was observed, in spite of the disinfection of the seed tubers, almost invariably the tubers themselves were disinfected some days before planting and were then left in the open air. The treatments usually adopted kill all the eggs present on the tubers. If larvae were found in the segments of tuber whence diseased plants sprang, the eggs of the Dipteron must have been deposited after the treatment and were doubtless the source of infection. Where the seed tubers were disinfected and planted immediately, very few cases of blackleg were observed. From this it is deduced that if the object of the disinfection of the seed tubers is to control the disease, the tubers treated should be planted immediately after treatment or else kept in a place inacessible to the Dipteron.

G. T.

644. ***Bacterium Salicis* n. sp. Injurious to *Salix caerulae* in England.**

DAY W. R. The Watermark Disease of the Cricket-Bat Willow (*Salix cærulea*). *Oxford Forestry Memoirs*, No. 3, pp. 30, figs. 17. Oxford, 1924.

A description of a serious epidemic observed in recent years on *Salix caerulea* (Cricket-bat Willow) in the Counties of Essex and Hertfordshire (England) and caused, as has been shown by inoculation tests, by a bacterium which the author describes and proposes to call for the time being *Bacterium Salicis* n. sop.

The largest trees are generally attacked, the wood of which, even in the first year of attack, greatly depreciates in value; after two or more years the tree dies.

Symptoms of the disease: general withering of the leaves (in May, or occasionally at the end of July) on one part only of the crown; the leaves then turn brown, hang down from the branches for a certain time and finally die; gradual death of the branches; frequent formation of adventitious shoots; bacterial exudation on the dying branches, which arises from masses of bacteria occupying the vascular tissues, and which issues through wounds in the bark caused for the most part by insects.

If an affected branch be cut through, there will be noticed in the area of wood occupied by the bacteria a dark-coloured spot, quite char-

acteristic and commonly known in Essex under the name of "Watermark", whence the name given to this disease, of "watermark disease of the cricket-bat willow".

On the dying branches attacked by the latter, the *Cytospore chrysosperma* (Per.) Fr. fungus develops during the summer: observations in the open field and experimental tests made in connection therewith, revealed the fact that the fungus is a saprophyte, capable of developing normally on dead tissues, also a possible parasite which can attack and kill living tissues, provided they are already weakened or predisposed to the disease; but *Cyt. chrysosperma* alone is incapable of causing the death of a healthy and vigorous tree.

The infection caused by *Bact. Salicis* always starts in the crown of the tree. This bacterium is a strictly vascular parasite which penetrates into its host through wounds already existing on the smallest branches, generally caused by insects which themselves may serve as a vehicle for the disease. After the disease has commenced to spread, the bacterial exudation undoubtedly constitutes a source of infection by which the bacteria are diffused from tree to tree.

The presence of the micro-organism is limited to the larger vessels of the wood; it was not found in the leaves or in the smaller roots.

The death of the organs of the tree which are attacked, is chiefly due to the stoppage of the water supply which takes place in the tree, through the closing up of the vessels by masses of bacteria. Another and generally secondary cause of death is the poisoning of the sap by the by-products of the bacteria and by substances produced by the dead parenchymatic cells in the wood.

From observations made in the open field it seems that trees which grow in a locality with a permanently moist subsoil are more subject to the disease than trees situated in places with a moist but well drained, or even very dry subsoil. The diffusion of the disease is also favoured when the trees are planted too close to one another. The best means for the control of the disease is based on the selection of a suitable locality and strict observance of the general rules of hygiene. G. T.

645. ***Macrophoma Corchori*, a Deuteromycete Injurious to Jute (*Corchorus capsularis*) and other Plants in India.**

SHAW F. J. F. Studies in Diseases of the Jute Plant. *Macrophoma Corchori* Saw. *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. XIII, No. 6, pp. 193-199, 2 plates. Calcutta, 1924.

In Eastern Bengal and E. Behar the jute plant (*Corchorus capsularis*) is sometimes attacked by a stem rot. The disease generally attacks the stem near the ground or somewhat higher, and in the first stages causes a pale reddish brown colouring, gradually changing to brown, which spreads along the stem and all round it until the whole plant dies. Sporadic cases of this stem rot may be found in almost every jute field, but only in certain conditions of cultivation does the disease become epidemic. It may attack the jute plant at any stage of its growth, and

thus shows itself both on *C. capsularis* and *C. olitorius*. Very young seedlings die with symptoms of 'damping off', the hypocotyl becoming soft and completely rotted. In such specimens an abundant mycelium develops in the tissues of the young fruit. In more mature plants the mycelian growth is accompanied by a copious formation of small black sclerotia in the interior of the stem among the fibres and by the development of pycnidia visible as black points just below the cuticle.

An examination of the diseased stem reveals the fact that the fungus consists of brownish hyphae and deep black sclerotia. Both the hyphae and the sclerotia are intermingled with the fibre. On the surface of the stem are to be seen numerous small black pycnidia.

The inoculation tests show that the pycnidia and sclerotic forms belong to the same fungus, which the author has identified as *Macrophoma Corchori* SAW, described as a new parasite of the jute plant in Japan in 1916. The pycnidial form is seen only on the jute plant and has never been obtained in artificial culture. The sclerotic form on the other hand develops in artificial culture and also on jute and cotton plants, potato tubers, etc. Cultures isolated from the jute, cotton, and potato, give rise to the pycnidia form when inoculated on the jute plant.

It was observed that the quantity of potash present in the soil is a determining factor of the disease: tests now being made at Pusa show that *M. Corchori* can develop a vigorous mycelium if cultivated in a substratum not containing potassium. Field tests made at Dacca also point to the fact that jute is a plant which reaches its greatest development when the quantity of potash available in the soil exceeds that normally required by other plants. G. T.

646. ***Phytophthora omnivora* var. *Arecae*, Peronospora Injurious to the Coconut Palm in Malabar.**

SUNDARARAMAN S. and RAMAKRISHNAN T. S. *Memoir of the Department of Agriculture in India, Botanical Series*, Vol XIII, No. 4, pp. 87-97. Calcutta, 1924.

In many districts of Malabar, Canara and Maipur, the betelnut (*Areca Catechu*), has been subject for some years to a disease commonly called "Mahali" or "Koleroga", which causes the rotting and fall of the fruits and in severe cases the crown of the palm itself. A disease in many res-, pects resembling this was reported as injurious to the coconut palm for the first time in August 1922, in some parts of Malabar, after the violent south-westerly monsoon. Owing to the fact that the symptoms of the disease are similar in both cases, the growers in Malabar also give the coconut-palm disease the name of "Mahali".

It causes large numbers of the nuts to fall, both young and mature, and the latter, if attacked, are dark or blackish brown, either at the base only or over almost the whole of the lower half. In nuts which have recently fallen, the brown spots have a fine whitish covering which under the microscope is seen to be formed of the mycelium zoosporangi

of a Peronosporaca (*Phytophthora*). If one of these fallen nuts be split open, the pericarp is found to be soft and rotted in those parts which correspond to the external spots, the kernel also is soft and partially or wholly rotted, has a disagreeable odour and is unfit for consumption. Under the microscope it is seen to be completely invaded by the mycelium of the fungus. The milk contained in the nut becomes brownish and emits a foetid odour. Sometimes both the principal and secondary axes of inflorescence are attacked.

The Peronospora has been cultivated and culture inoculation tests have been made at Coimbatore on the fruits and buds of the coconut and areca; such tests have shown that the fungus may be considered to be the agent of the disease. The inoculations also showed that this fungus is identical with *Phyt. omnivora* var. *Arecae*, which causes the disease in the betel nut known under the name of "Mahali" or "Kole roga".

The disease appears on the coconut only when the palms grow up with *A. Catechu*, which, after being attacked by "Koleroga", in their turn infect the coconut palms.

The means adopted for control of the disease on *A. Catechu* may also be used for the coconut: all the diseased and spoiled nuts lying on the ground are collected and burned, together with the other affected parts removed from the tree, after which the inflorescences are sprayed with Bordeaux solution. The treatment should be applied immediately before the rains set in and again during an interval of fine weather.

G. T.

647. **Diseases of the Coffee Plant in the State of São Paulo (Brazil).**

AVERNA-SACCÀ, E. Segunda contribuição para o estudio das molestias cryptogamicas do cafeeiro. *Secretaria da Agricultura, Commercio e Obras Publicas do Estado de São Paulo, Serviço de Publicações*, 63 pp., 21 figs. São Paulo, 1925.

The first contribution to the investigation of the fungous diseases which attack coffee in the State of São Paulo (Brasil) was published by the author in 1917. The present one, which has now been printed, completes the preceding one, recording some fungi new to science and giving further information on some old diseases, which deserve the greatest attention on the part of planters.

It should not be thought that the numerous fungi described and illustrated in these two works include all those which live on the coffee-plant in the State: besides the mycetes he has been able to gather and examine, many others must exist over the whole of the coast zone.

In the present publication the author examines the following fungi:

(1) *Glomerella coffeicola* Averna n. sp. (conidial form): *Colletotrichum incarnatum* Zimm; f. spermogonia: *Cytosporina coffeicola* Averna

n. sp. ; f. pycnidia : *Diplodia coffeicola* Zimm.; f. ascophore : *Gl. coffeicola*, which cause the disease, locally known as " gueima do cafeeiro ";

(2) *Pestalozzia coffeicola Averna :*

(3) *Clasterosporium coffeanum* Averna ;

(4) *Hendersonia coffeicola* Delacroix ;

(5) *Stictis coffeicola* Averna ;

(6) *Lachnea hemisphaerica* (Wigg) Gill ;

(7) A sterile mycelium, which causes a form of root rot ;

(8) *Chaetophoma coffeicola* Averna ;

(9) *Nectria coffeigena* Averna (conidial form : *Fusarium coffeicola* P. Henn., f. ascophore : *N. coffeigena*) ; Common names : "café chocho", " cancro do café " ;

(10) *Sphaerostilbe flavida* Massee (sin. *Stilbum flavidum* Cooke ; *Pistillaria flavida* Speg. ; *Stilbella flavida* Kolh ; *Omphalia flavida* Maubl. et Rang.) ; Common Brazilian name : " regueimado ".

Having described the injuries caused by the above fungi, the author gives their morphological characters and the best means for their control.

G. T.

Animal Parasites.

648. **Orthoptera in Bengasi.**

ZANON, V. Contributo alla conoscenza della fauna entomologica di Bengasi. Ortotteri di Bengasi. Extract from the *Memorie della Pontificia Accademia delle Scienze Nuovi Lincei*, Vol. VII, pp. 23. Rome, 1924.

Enumeration of 47 species of Orthoptera collected by the author in the Bengasi districts from 1915-1919. While all are important from a scientific point of view, according to the author, systematic and biological knowledge is lacking as regards the representatives of this order of insects in Libya and some are also important from the economical point of view, because recognised as injurious to various crops.

The list is preceeded by a detailed account of a notable invasion of locusts, the flight originating from the South, the predominating variety being the « speckled locust » (*Tettigonia albifrons* Fabr. *Decticus albifrons* Serv. ; in Arabic, " bugerada " or " bugiarada "), from which the Bengasi zone suffered in 1918-19.

The garden crops and seeds were destroyed ; ripening barley and wheat were also involved and the wells defiled. Vines suffered only slightly ; some bunches of grapes were nipped off, but the leaves remained intact.

The presence of various natural enemies was observed (*Sphex flavipennis* hymenoptera, and the following birds : *Tinnunculus vespertinus*, *I. neumanni*, *Emberiza citrinella* and sparrows), but for various reasons their intervention in the campaign against *T. albifrons* was insufficient.

G. T.

[648]

649. **British Coccidae.**

GREEN, E. Observations on British Coccidae, IX. *The Entomologist's Monthly Magazine*, Vol. LXI (3rd Series, Vol. IX), No. 729 (No. 122) pp. 34-44, 5 figs. London, 1925.

Kuwania pini, which the author describes as a species new to science, was collected on *Pinus sylvestris*, at Oxshott (Surrey). This is the first time that the presence of a Coccida on pines has been reported in the British Isles.

On branches of *Hoheria populnea*, in the Scilly Isles, *Eriococcus hoheriae* Maskell was observed. This is the first time the insect has been found outside its native country (New Zealand).

The following are also described as species new to science : (1) *Pseudococcus* (*Trionymus*) *phalaridis* living on *Phalaris arundinacea*, at Frimley (Surrey) — it has a very effective natural enemy (which preys on the *Ochthiphila polystigma* larva) ; (2) *Ps.* (*Tr.*) *peregrinus*, on the roots of the *Nerine flexuosa* Amarillidaceae, at Exbury, near Southampton ; (3) *Lepidosaphes laterochitinosa*, on *Coelogyne* sp. at Wisley (Surrey).

In the already long list of the host plants of *Lecanium persicae* (Fab.), *Tamarix*, on which the Coccida was collected at Andover (Hants), should be included. Such a discovery is of special interest as it is the first time a Coccida has been reported to be found on such a tree in Great Britain.

A specimen of *Laurus nobilis* was found very seriously infested by *Aspidiotus britannicus* Newst (the locality where the observation was made is not indicated).

Lepidosaphes ulmi (L) was found on *Helianthemum vulgaris* (on the Hog's Back, near Guildford) and on *Erica Tetralix* in the neighbourhood of Camberley.

G. T.

[649]

CURRENT NOTICES

Legislative and Administrative Measures.

650. **The Fruit Wines of Costa Rica.** — The production of these wines has been regulated by the decree of December 1924. (*La Gaceta*, 24th of December 1924).

651. **Control and Protection of Forests in Spain.** — The Royal decree of March 12th. 1924, gives general directions respecting the protection of forests against diseases and pests.

The "Ministerio de Fomento" may contribute to the expenses entailed in this respect by town councils and private persons. Further provision may be made for the formation of syndicates composed of proprietors of the attacked zones, who by cooperation will be better able to control pests. The Royal Order of February 21st., 1925 has regulated State support in this matter. (*Gaceta de Madrid*, 26 February 1925),

652. **Spain. The Felling of Trees on Private Property.** — Further instructions were issued in this respect on the 4th of March, 1925, in addition to the *Royal decree* published on December 3, 1924.

653. **Spain. Regulations concerning Wines and Alcohol.** — Published in a *Royal decree* of September, 1st 1924; the question is treated principally from the fiscal point of view. Attentionis drawn to article 7, which states that in order to prevent over-production of wines, which would naturally cause difficulties in the wine-markets, new plantation of vineyards is prohibited with the exception of special cases.

654. **France. Repression of Fraud in the Fertiliser Industry.** — The decree of March 19th 1925, supplements the former law of February 1888. Regarding the repression of fraud in the fertiliser industry, it is preseribed that all commercial documents together with the labels on the packages must state full details as to the chemical substances contained in the fertilizer in order to protect the purchaser from fraud. (*Journal Officiel*, 22 March 1925).

655. **France. Regulation of the Trade in Cereal Seeds.** — With the presidential decree of 26 March 1925 the selling of wheat seed packed in any other than the prescribed way is forbidden. The labels on the packages must bear information as to the variety of wheat, its origin and the average percentage of this wheat in the package. Only such wheat may be sold as first class or choice seed, and that which is obtained by individua

selection must contain not more than 1 % of seeds of other varieties than the one indicated. The germination capacity of the wheat, when not specified, must not be less than 85 %. (*Bulletin de l'Office de renseignements agricoles*, No. 7, 1925).

656. **Colonisation in Algeria.** — Measures have been taken for the reservation of State lands for colonisation in Algeria. (*Bulletin officiel*, December 3rd, 1924).

657. **Morocco. Decree for the Agricultural and Silk-Industries.** — A Vice-Regal decree has been issued dated Dec. 20, 1924, concerning the distribution of prizes for motoculture; for the preparation of land for planting or for the grafting of olive and carob trees, and for planting of mulberry-trees. (*Bulletin Officiel*, 30 December 1924).

658. **Martinique. The Encouragement of various Plantations in Martinique.** — By special decree a bonus for various plantations has been established, as follows: for each coconut palm 5 fr.; for each lemon-tree 2.50 fr.; cacao and bananas 1.50 fr.; coffee and sisal, 0.50 fr.; vanilla 0.30 fr.; cotton 0.10 fr.; tobacco 0.05 fr. Arrangements have been made for the distribution of these bonuses and practical instructions respecting the various plantations have beeen published. (*Journal Officiel de la Martinique*, July 10, 1924).

659. **Measures for Protection of Plants against Parasitic Diseases in French Oceania.** — By special decree amending the decree issued January, 1916, measures have been taken to forbid the importation of coconut palms, and all other kinds of palms, as well as of coffee plants, banana plants and other Musacea. The regulation applies also to their fruits, leaves or seeds. (*Journal officiel des Etablissements français de l'Océanie*, December, 1924).

660. **Italian Laws and Decrees respecting Land Improvement and the Granting of Agricultural Credits.** — The Royal Decree of February 5th, 1924, exonerates the communes from contributing to the land improvement tax hitherto sustained by them alone. Further provision is made for the collaboration of the State and the Provinces as regards the rate of interest charged on loans. The Royal Decree dated February 8th, 1925, appoints an interministerial Committee, with powers to carry out improvement of lands in the public interest. The decree of 19 February, 1925, of the Ministery of National Economy treats of agricultural credits; of the agricultural credit Banks of Caserta and of Lecce. The decree of the same Ministery, dated 31st of January, 1925, deals with the granting of loans for agricultural purposes.

661. **Measures for the Control of Plant Diseases in Italian Somaliland.** — By two Governmental decrees of November 1924, the importation of seeds, plants and parts of plants without special permission of Government authorities is prohibited. The importation of American cotton seed is prohibited and an eventual disinfection or even destruction of the existing imported plants is ordered as well as the immediate destruction of the cotton plants after picking is over. In some cases the total or partial destruction of the entire crop is ordered even before picking. Seed not used in oil factories, or for sowing is also to be destroyed.

662. **Holland. Ministerial Regulations for the Control and Marking of Cheese.** — The Dutch Minister of the Interior and Agriculture, Department of Agriculture, Section V, has published instructions amending previous

laws (23 March, 1925) in respect to the examination of samples of fat cheeses (1st quality) as well as those of skim-milk cheeses, and the analysis of samples. Analysis is made in respect to the percentage of fat, which is determined by quantitative and empirical methods. (*Nederlandishe Staatscourant*, 15 April, 1925, No. 72).

663. **Paraguay: Cotton Seed in Paraguay.** — In virtue of Art. 1 of a decree No. 18218, the cotton planters and exporters of cotton must keep in reserve 30 % of seed obtained every year, in order to supply the requirements of the next crop.

Art. 2. of the same decree forbids the importation of cotton, if not accompanied by a special certificate, to be issued by the Banco Agrícola.

664. **Rumania: New Regulation for Wheat, Flour and Bread.** — Legislative measures are published in No. 4 of the *Monit. off* (6th January, 1925), by which the exportation of wheat and its derivatives is prohibited. The national mills are obliged to recover from the wheat integral flour to the extent of 85 %.

In time of urgent need, or war, the Government is empowered to seize all wheat and flour required to supply the needs of the population or army. Maximum prices are fixed for wheat standard flour, for the flour already in store, and also for the above-mentioned Government requisitions.

665. **Venezuela: Protection of Forests and Water Reserves of Venezuela.** — A law has been issued dated June 1924, respecting State and private forests, the maintenance of the public and private water supply, the navigation of rivers, concessions for the erection of hydro-electric works, the maintenance of lakes, wells, etc.

Experimental Stations and Agricultural Instruction.

666. **Germany: A German Research Laboratory for Chemical Fertilizers.** — The *Chemiker Zeitung*, March 10th, 1925, announces that the « Kaiser Wilhelm Society » intends to found a research laboratory for fertilizers. This Institution will collect and co-ordinate imformation on the subject, not only of the different fertilizers, but will study also the complicated questions of plant nutrition and the fertility, and properties of the soil. Furthermore it will study the best methods of application of fertilizers and the action of stimulating chemical substances, accomplishing in this respect a revision of the the studies already completed by others. This Institution will therefore constitute a Research Station in the widest sense of the word, studying problems of soil, plants and fertilizers in all their inter-relations.

667. **Germany: A Hydrological Research Station** has been founded at Obernachtal, by the Bavarian Government, near the laboratories of the « Kaiser Wilhelm Gesellschaft » at Walchensee.

668. **Phenological Maps published by the German Phenological Service.** — Under the direction of State Councillor Prof. E. Werth, phenological maps have been published in No. 25 of the *Mitteilungen aus der Biologischen Reichsanstabteilung für Land und Forstwirtschaft*. This number was issued in December, 1924, and forms the annual for 1922, of the *Phänologischen Reichsdienstes*.

669. **Germany: The "Karl-Heinz-Thost Foundation".** — The *Deutsche botanische Gesellschaft* has opened a competition to all German and Austrian-German botanists on the subject: "To promote by personal original research and by critical annotation from recent literature the study of the influence of the duration of daylight on the growth of the plants". For this competition a prize of 500 gold marks has been offered by the « KARL-HEINZ-THOST » Fund. The answers should be addressed to the President of the *Deutsche Botanische Gesellschaft* in Berlin not later than April 30th, 1926. The judging committee consists of Professors C. CORRENS, L. DIELS and H. KNIEP.

670. **Brazil: Programme of the Experimental Station for Cocoa in Brazil.** — The Brazilian Minister of Agriculture has organised a programme of work to be carried out in the current year by the Experimental Stations for cocoa of Ilhéos in the State of Bahia and of Goyatacazes in the State of Espirito Santo. Following is a resumé of this programme: (*a*) to remove the plants from the soil of the fazenda and to space out ground for the new, simple, experimental cultivations; (*b*) to carry out planting experiments with Criollo cocoa, the distance between plants to be 5 metres, part of the plants to be grown under shade and part without shade. Cultivate each year half of the ground for each part; (*c*) carry out similar experiments with other varieties of cocoa, but varying the distance between the plants; (*d*) use as shading trres "molungu" and other trees of the leguminous family, taking care to use small leguminous trees as long as the cocoa plants are still small; (*e*) to plant on small plots of ground, at a distance from those plantes with "Criollo" cocoa, the varieties that are also found at S. Bento das Lages; (*f*) to ascertain the best conditions for each variety of cocoa with respect to adaptation and productiveness, in relation to atmospheric humidity, soil formation, nature and depth of the subsoil, chemical composition of the soil, the movement of water, subterraneous water-table, etc.; (*g*) to study the influence and the advantages of pruning and grafting and above all the increased production of the better varieties or of the most productive trees; (*h*) to ascertain the yield per hectare and per plant of each variety of cocoa, shaded and not shaded, and varying distances between the plants, with cultivated or uncultivated ground, with or without the use of fertilizers; (*i*) to keep cattle in the Station in order to demonstrate the utility of manure, and to use also the cocoa residues for the fertilization of the plantation, leaving parts without fertilizers for comparison; (*j*) to plant on the plots already used for cocoa, intermediate rows of "seringueiras" (seeds and cuttings of S. Bento das Lages) and to suggest such measures to "fazendeiros" whose grounds no longer produce cocoa in satisfactory quantity; (*k*) to plant certain lots with "Robusta" and "Stenophylla" coffee, also derived from S. Bento dos Lages; (*l*) to plant on the Station grounds tea, quinine, camphor, oriental pepper, chalmoogra, etc. with seeds from S. Bento dos Lages or from the "Istituto Biologico de Difesa Agricola"; (*m*) to maintain nurseries for the growing of the best qualities of cocoa and other useful plants of the region, including forest-trees such as eucalyptus, teak, etc, using plants from the Botanical Gardens; (*n*) to inspect the plantations of the zone, determine the diseases and their causes, to study the means of remedy and the methods of treatment and to ascertain the maximum or minimum resistance of

each cocoa variety against these diseases, and to ascertain their causes; (*o*) to study the fermentation and drying of cocoa by means of practical experiments, until definite results are obtained; (*p*) to show the advantages and disadvantages of the washing of cocoa; (*g*) to grade the various kinds of cocoa so as to obtain better quotations on the markets; (*r*) to study the immunity of cocoa to mould; (*s*) to study the uses of the hull and the pulp of cocoa. (*Gazeta da Bolsa*, Year VIII, No 6, Rio de Janeiro, 1925).

671. **Spain: The Agricultural Fields ("Campos agrícolas") attached to the National School in Spain.** — The sum of 1000 pesetas has been placed at the disposal of the Director of each of these fields, available for the scholastical year 1924-1925. (Royal order, 17 February 1925, published by the President of the Direttorio Militare).

672. **United States: Experiments on Growing of Sugar-beet in Louisiana, U. S. A.** — The results of these experiments may be summarised. as follows: (1) on hilly ground near the Bâton-Rouge and on land in the East of Louisana once covered with pine forests, sugar beet was successfully planted. The beets had a sugar content of 13-14 %, and purity 80-85 %. Alluvial soil will probably prove favourable for this crop. (2) The yield may reach 10 to 15 tons per acre. The average yield per acre for the United States is about 9.5 tons. (3) The cost of production is relatively low. (4) The duration of the harvest varied in the last years from 6 to 12 weeks, beginning early in May. (5) The experiments show that the sowing should take place earlier, e. g., in September-October. (6) The beets at harvest time weigh from 1-2 lb. Uniformity in size indicates good quality but is not indispensable. (7) In the experiments at Bâton-Rouge no fertilizers whatsoever were used. (*Chemical News*, Vol. 130, No 3389, pp. 9-25).

673. **Nebraska (U. S. A.). Experiments in Cereal Growing.** — Messrs. L. L. York and W. W. Durr of the Nebraska Experiment Station have published in a special "Bulletin" the results of researches made during 16 years in corn-growing at the North Platte Dry-Farming Sub-Station. (*The Agricultural Review*, April 1925).

674. **New courses of Rural Science at the "Virginia Polytechnic Institute".** — To the instruction in this polytechnic school which extends over 4 years and includes the study of various branches of science concerned with Agriculture, have been added the following courses: Agricultural Geography, History of Agriculture in America, History of English Industry, Statistical Methods of Agricultural Accounting, National Economy, Rural Economy and Rural Sociology. Courses on marketing of agricultural products, on rural co-operation and on the cost of production of agricultural products, had already been held. (*Journal of Farm Economics*, Vol. VI, No. 3).

675. **International Seed Exchange.** — Nearly a hundred botanic gardens issue annually or biennially a seed list for the purpose of mutual exchange; these gardens are chiefly in Europe. Those in Asia are: Tokyo, Sapporo, Buitenzorg, Tiflis; in Africa: Kirstenbosch near Cape Town, Tunis; in South America: Montevideo; in North America: Ottawa and Brooklyn. The Curator of Plants, Dr. Gundersen of Brooklyn Botanic Garden, U. S. A., invites correspondence on this matter. (*Science*, Vol. IX, No. 1543. Lancaster, Pa., 1924).

676. **United States: Annual Report of the American Research Laboratory for Fixed Nitrogen.** — The director of this Laboratory, F. G. COTTRELL, gives an account of work carried out during the 5th year. The most important investigations refer to: (1) the synthetic ammonia process, the cost af which may be reduced by 50 %, by a better use of catalytic agents; (2) the fixation of nitrogen as cyanides; (3) the fixation of nitrogen as nitrate of aluminium in order to obtain aluminum and ammonia; (4) researches on cyanamide, and also on nitrogen-fixing microorganisms, and on the recovery of oxides of nitrogen from the gaseous mixtures obtained by the oxidation of ammonia.

Special attention was given to the fixation and utilization of atmospheric nitrogen and to the fundamental principles of the process. From this standpoint it is important to know the conditions under which the molecule of nitrogen can unite with other elements.

The production of active oxygen and of ozone is connected with the same problem as well as the reversibility of these processes. The work on the explosive decomposition of ozone shows the possibility of using the electric arc process for nitrogen fixation and also for the formation of nitric oxide.

Seventeen scientific publications have been issued during the past year, as well as publications of an informative or commercial character. (*Annual Report of the Director of the Fixed Nitrogen Research Laboratory*. pp. 1-5, Washington, D. C., 1924).

677. **American Foundation for the Study of the Chemistry of Wood and its Derivatives.** — The "Northwest Paper Company" and the "Cloquet Lumber Company" of Cloquet (Minn.) have given a fund of $4000 to the Agricultural Biology Section of the University of Minnesota to encourage the study of the chemistry of wood and its derivatives as well as the utilisation of wood products.

678. **Cuba: Note on "Mosaic" of Sugarcane.** — In order to promote these studies a new credit of 6000 pesos has been given, in November 1925, in addition to former endowments. (*Gaceta Oficial*, 28 November, 1924).

679. **France: A Technical School for the Study of Petroleum** has been founded at Strassburg by the French Government for the instruction of specialists and the development of scientific or technical studies on combustible liquids. The School is divided in 3 sections: Geology, development, chemistry of petroleum. (*La Journée industrielle*, 28 December, 1924).

680. **Morocco: A Native School of Agriculture** was opened at Fez on January 1st, 1924. Two kinds of instruction are provided, general and technical. The general instruction includes: the Freuch languages, mathematics, surveying, levelling, economic geography, hygiene. The tecnical courses consist of: botany, agriculture, horticulture and fruit-growing, principles of agriculture from a physical and chemical point of view, agricultural mechanics, anatomy and physiology of animals, hygiene and stock-breeding. Half a day each week is given to practical demonstrations on the experimental farm (700 hectares), situated near the gates of Fez (Bab Segma). At certain times pupils stay for several days on the farm, under the direction of the instructor or of one of the Professors, and take part in ploughing, sowing, weeding, grafting, reaping, grape-gathering, pruning, fruit-picking, etc. The greater part of

the stock-breeding courses are given at the veterinary Station in the town. (*Renseignements coloniaux et documents publiés par le Comité de l'Afrique française et le Comité du Maroc.* Suppl. nº 3 de l'*Afrique française*, 1925).

681. **Professional School of Agriculture in Porto-Novo (Dahomey).** — In accordance with a decree of 16 October 1924, the Lieutenant-Governor of the Colony has re-organised this School. (*Journal Officiel de la Colonie du Dahomey*, November 1st, 1924).

682. **Great-Britain : Agricultural Research in France and Great-Britain.** — Mr. W. R. BLACK, of the Ministry of Agriculture and Fisheries has written a short comparative study on French and British Agricultural Research. He states that this service has been introduced more recently in France than in Great Britain. In France it dates from the year 1921 and in Great Britain it was installed in 1909. Research in the following subjects is carried out by both countries : Soils, plant pathology, plant breeding, cattle feeding, stock-breeding, animal pathology, farm engineering. In Great Britain the following branches are especially studied : plant physiology, horticulture, glasshouse crops, agricultural economics. In France the special branches are physics and meteorology from an agricultural point of view and agricultural bacteriology. The author points out the similarities and differences between the systems of the two nations and mentions that in France there is a stronger tendency towards centralization

The British organization is gradually becoming more centralized without diminishing the liberty of the workers. In respect to personal remuneration and the valuation of scientific material, it is stated that French officials have less advantages than the British. (W. R. BLACK, "Agricultural Research in France, a comparison with Great Britain"; *The Journal of the Ministry of Agriculture*, p. 36-46, 1925).

683. **Great Britain : Experiments on Broccoli Growing** have been carried ont at Gulval, Cornwall, a country which markets about 15,000 tons annually. The varieties are discussed, and the results of selection and hybridisation, also, methods of cultivation, manuring, and the importance of grading and packing. (H. W. ABBISS, *Jnl. of Ministry of Agriculture*, Vol. XXXI, No. 12, 1925).

684. **Australia : A National Museum for the Study of Australian Fauna** has been established at Canberra and promises to become an international centre for the study of Australian fauna. As is known, after the introduction of civilisation and of European fauna many Australian types of mammals have disappeared.

Dr. COLIN MACKENZIE had founded the "Australian Institute of Anatomical Research" in Melbourne, for zoological and comparative anatomical studies. This Institute includes also a Museum and a Laboratory. In 1923 Dr. MACKENZIE gave to the Government his laboratory instruments and equipment and collection of zoological specimens both living and dead. This Collection will form the nucleus of the National Museum, which will be under the direction of Dr. MACKENZIE. (*Science* v. LXI, No. 1881 ; 1925).

685. **Trinidad : Instructional and Experimental Sugar Factory of the Imperial College of Tropical Agriculture.** — On February 20,1925, Sir HORACE BYATT, K. C. M. G., Governor of Trinidad and Tobago, officially

opened the new Sugar Factory of the Imperial College of Tropical Agriculture, the first of its kind in the Empire. The machinery of the factory valued at not less than £ 20 000, has been presented by firms of the British Sugar Machinery Manufacturers' Association. A detailed account of the history of the factory, the College Course in Sugar Technology, and a description of the machinery is given in the *Supplement to Tropical Agriculture*, Vol. II, No. 4, 1925.

686. **A New Zealand Demonstration Farm.** — The Stratford Demonstration Farm has an area of 143 acres and carries out demonstration work in connection with pastures, root-crops, green crops and lucerne. The dairy herd has been improved by a good bull and good feeding; the average butter-fat production per cow bas risen from 221.1 lb. in 1919-1920, to 305.0 lb. in 1923-1924, the improvement being largely attributed to better feeding. The results obtained are published in the local papers and are carefully followed by farmers, who visit the Demonstration Farm and view the work. Development proceeds at a moderate pace, as extension is dependent upon the income earned. (*New Zealand Journal of Agriculture*, Vol. XXIX, No. 6. Wellington, 1924).

687. **An Australian Agricultural Research Institute** has been established by the University of Adelaide, owing, to the gift of £ 100 000 by M. PETER WAITE, a well-known sheep farmer of South Australia. The Government has granted a subsidy of £ 5000 per annum in addition. The Institute will be known as the Waite Agricultural Institute and is situated at Glen Osmond, about three miles from Adelaide; the farm has an extent of 300 acres. Research will be carried out on general agriculture, chemistry, plant diseases and plant breeding. (*Jnl. of Ministry of Agriculture*, London, XXXII, No. 1, 1925).

688. **Italy: Production of Pure Seed in Italy.** — A Summary on the cultivation of cereals ot the "Amministrazione Marcello in Fontanella di Odezzo" in the Marca Trivigiana has been published, with a preface by Dr. G. M. MARANI, the technical Director of the "Cooperativa Trivigiana per la produzione delle buone sementi". This publication compiled by Count A. MARCELLO one of the proprietors of a farm in Fontanella, gives information on experiments carried out with varieties of wheat, maize and sorghum. The administration has experimented in the improvement of maize cultivation by genetic selection, mass-selection, and the introduction of new varieties. On Count MARCELLO's farm it has been shown that the best results are obtained by mass-selection, as proved by the abundance of the harvests, general uniformity and earliness of maturity.

In regard to sorghum, Japanese varietes, Minnesota, Ariambler and Honey varieties have been grown.

889. **Italy. Italian Scholaships for Farm Engineers.** — The "Opera Nazionale per i Combattenti in Italia" (for ex-soldiers) in order to obtain the best technical farm engineers (agricultural hydraulic, soil improvement, rural electrification) has granted two scholarships of 6000 lire each. These scholarships are to be given in 2 annual endowments in the scholastic years of 1924-1925 and 1925-1926 to enable ex-soldiers, who have graduated as civil engineres to attend the "Ecole supérieure du Génie rural" in Paris.

Attached to the school is an agricultural Station for hydraulic reseach which offers a course extending over two years.

The first year includes lectures, practical work and the studies of various types of farm engineering, also, excursions and visits to different industrial plants with periods of training.

During the second year of study, in order that the enrolled engineers may become more proficient in agricultural electrical work, opportunity is given to attend the " Ecole supérieure d'électricité " in Paris, where students may obtain the diploma of electrical engineer.

690. **Italian Competition in Agriculture.** — In 1908 the " Cassa di Risparmio " in Bologna established a prize to be given every four years. This prize is in memory of CESARE ZUCCHINI who for more than 27 years directed without remuneration this Institution. The first competition was opened in 1910 and closed in 1914 and was won by Prof. FRANCESCO TODARO, professor of Agriculture in the " R. Istituto Superiore d'Agricoltura " at Bologna, through his studies in the breeding of cereals.

During the war and in the following years the prizes were abolished, but on the first of April of the present year the competition has been re-opened. The competition consist of two main sections: (1) the best work, discovery, invention, the scientific or industrial application relative to new means and methods for the control of agricultural plant diseases (second competition); (2) and against the diseases of domestic animals employed in agriculture (third competition). For each of these competitions a prize of 15,000 lires, a gold medal and diploma has been authorised. All manuscripts, samples, etc. should be addressed to " Fondazione del Premio Quadriennale CESARE ZUCCHINI presso la Cassa di Risparmio di Bologna ". The competition ends on March 31st, 1929.

691. **Italy: Foundation for Study of Feeding of Dairy Cows.** — The R. Istituto Lombardo di Scienze, Lettere ed Arti has received an endowment from the Cav. LUIGI ALLACCHIO of a million lires with instructions to use the interest in prizes for the study and technical improvement of the nutrition of dairy cows and the disposal of the by-products of milk. The regulations will be drawn up by the Institute with the sanction of Prof. CONSTANTINO GORINI.

692. **Italy: Prize Competition; Organic Chemistry as applied to Agriculture.** — The R. Istituto Superiore Agrario of Milan has opened a competition (Fondazione Körner) for the best work in agricultural organic chemistry. The prize is 3000 lire. All replies must be sent to the above mentioned Institute, Via Marsala, 8, Milan, not later than Dec. 31st, 1929.

693. **Italian Scholarships for the Improvement of Studies relating to Fish.** — By a Ministerial Decree dated 26 February, 1925 three scholarships have been opened for the study of fresh water, lake and sea fish. Each scholarship has a value of lire 9000 and is open to graduates in natural science or chemistry.

Associations and Agricultural and Scientific Institutions.

694. **The International Federation of Aviculture.** — In accordance to the decision of the Congress held at Barcelona in May 1924 to reconstitute

the International Federation of Aviculture, formed at Brussels in 1905, the delegates of the different nations, invited by the "Fédération des Sociétés d'Aviculture de Belgique" met in the Belgian Ministry of Agriculture in January last and reformed the statutes of the International Federation. Included in work carried out by the new Federation are the following: the revision of standards defining a pure race and the principles to be followed in their application in International Exhibitions; sanitary and Customs regulations; regulation of the trade in eggs and poultry; Poultry Congresses. For these last it is stipulated in the Statutes that the Federation should act in conjunction with the International Associations of Poultry Instructors and Investigators, which has organised the World Congresses held at the Hague and Barcelona and will assist in the organisation of exhibitions. (*La Revue Avicole*, Year 35, No. 3, 1925).

695. **Austria: The Viennese Agriculture and Forestry Club.** — On March 10 of the present year the "Klub der Land- und Forstwirte" celebrated its 50th anniversary.

In 1875, when founded, there was a membership of 152 which rapidly increased to 500. After the war the membership, fell to about 250.

The Government agricultural adviser, Dr. G. v. HAMM was the founder of the Club. The President is now Dr. M. WILLNER, Director General of the *Land- und Forstwirtschaftlichen Betriebsgesellschaft.*

696. **Columbia. The XXth Anniversary of the Agricultural Association of Columbia.** — Sig. RAFAEL FLOREZ has published a pamphlet on the work of the association (Sociedad de Agricultores de Colombia) during the last 20 years, which was founded in November 1904, under the name of "Sociedad de Productores de Café" which in 1906 was changed to the present title. In 1908 the first number of the "*Revista Nacional de Agricultura*" the periodical of the organisation appeared. The work of the association is described by FLOREZ and biographical sketches are given of the chief members. The present membership is 150 including 21 honorary members. The library of the Association contains a thousand volumes and numerous reviews and journals, national and foreign, which are consulted especially by veterinary and agricultural students. (RAFAEL FLOREZ, *Reseña histórica de las labores ejecutadas por la Sociedad de Agricultores de Colombia en los veinte años de su existencia*; pp. 62, small octavo, illustrated. Bogota, 1924).

697. **Ecuador Agricultural and Stock-Breeding Services.** — The law of October 1924 states that the stock-breeding and agricultural services are under the control of the Ministry of Agriculture.

698. **United States: The Development of the Federal Crop Reporting Service.** — The Federal Crop Reporting Service held its 61st anniversary in May 1924. The Service has developed into an organisation numbering over 300 000 voluntary reporters, 60 Government officials of the Statistical Service, 8 to 10 experts on agricultural production and 120 employees. Each year about 50 000 different reports are published. The work of this Service enables the Bureau of Agricultural Economics of the Department of Agriculture of the United States to publish fortnightly reports on the conditions, the development and the probable yield of cotton. (*Journal of Farm Economics*, Vol. VI, No. 3, 1924).

699. **United States : American Association for the Advancement of Science.** — A large number of scientific and practical institutions and organisations in the United States are now officially united to the American Association for the Advancement of Science. They may be classified as follows: mathematical 2, physical 3, chemical 3, astronomical 1, geological and geographical 8, zoological 6, botanical 6, zoological and botanical 5, anthropological 3, psychological 2, economic and sociological 5, engineering 9, medical 9, agricultural 9, instruction and philosophy 6, various institutions 6. In addition, 12 Academies of science of the different States of the Union are affiliated to the Association, which allows these Academies yearly subsidies for their academical work. (*Science*, N. S., Vol. LXI, No. 1579, 1925).

700. **Cuba. National Association of Horticulture in Cuba** founded by the horticulturists of Havana and Pinar del Rio under the patronage of the Secretary of Agriculture. One of the Association's chief aims is to induce the United States to withdraw the quarantine regulations imposed on Cuban fruit. The Association also endevours to promote rural co-operation, agricultural credits, irrigation, improvement of transport, improvement of rural life and the progress of fruit-growing. (*Bulletin of the Pan-American Union*, September 1924).

701. **France : A National Bureau of Cumbustible Liquids** has been formed in the Ministry of Commerce and Industry with the aim of furnishing to the administration and to French industry, by means of special notices or general publicity, information and documents to improve the distribution of combustible liquids. This Bureau will encourage necessary studies and may organize and support technical instruction concerning the various sections of the petrol industry and its by-products. By means of prizes research will be encouraged for the discovery of new sources of petroleum and of the scientifc application of carburants. The Bureau, if necessary, will carry out these researches itself and by the offering of prizes, encourage improvement of methods of extraction of hydro-carbons contained in the bituminous material in the national territory. The Bureau will decide on all questions appertaining to the distribution in the country of combustible liquids of every nature. It must be consulted on all matters of proposed legislation, on all decrees regarding the regulation of research, of transportation, maintenance, storage or distribution of national hydrocarbons. (*Recherches et Inventions*, Year VI, No. 112, 1925).

702. **France : Reports on the Works of the " Comité Central de Culture Mécanique "** in France, have been collected into a volume of the French review *Chaleur et Industrie*. They treat of the work of the Committee during the year 1924 and refer especially to the national carburants, to the Exhibition of Buc near Versailles and to the different Congresses that have taken place.

703. **The Isle of Réunion Water and Forestry Service** has been reorganised by a decree dated August 28, 1924. (*Journal et Bulletin Officiel de l'île de la Réunion*, Sept. 5, 1924).

704. **Annam Veterinary Sevice.** — A decree of the Governor General regroups the provinces of Annam into 5 veterinary districts.

705. **Report of the Department of Agriculture of the Union of South Africa.** — The *Journal of the Department of Agriculture*, Vol. IX, No. 6, consists entirely of the Annual Report for the year ended June 30, 1924. Separate reports are given by the Chiefs of Divisions: Agricultural Economics and Markets, Education, Education for Women, Systems of Schools of Agriculture, Agricultural Policy, Production, Costing, etc.

706. **Italy. Associations for Soil Improvement in Southern Italy and the Insular Possessions.** — At the meeting held in January 1925 of the Committee for the foundation of these associations, it was proposed to further the formation of these associations in Molise, Campagnia, the Puglia, Basilicata, Calabria, Sicily and Sardinia and to promote the formation of Provincial sub-committees. These sub-committees will assist local soil improvements and indicate the individual problems relative to the soil. (Communicated, February 1925, by the Committee for the Foundation of Associations for soil improvement in Southern Italy and the insular possessions).

707. **Italy. The "Federation Pro-Montibus" and its Work.** — This Federation which has recently been created a corporate body (Royal decree January 29, 1925) has steadily developed from it foundation in 1909. In 1909 the Federation was composed of only 5 federated bodies, it now has 433, among which are 24 Associations Pro-Montibus, 42 provincial associations, 52 hydro-electric works, 25 local bodies, 256 forestry firms and about forty other organisations. The Federation Pro-Montibus deals with the following: (*a*) forestry and allied indutries and trade; (*b*) bee-keeping and other mountain industries; (*c*) regulation of the water-supply of the forests and its economic utilisation; (*d*) conservation of natural resources; (*e*) protection ot professional interests; (*f*) the study and resolution of all questions relating to mountain districts. During the past 15 years of its activity the Federation has organised 4 Italian Forestry Congresses at Bologna, Naples, Turin and Udine, as a result of which have followed legislation regurding forestry and measures relating to water conservation in the mountains, and laws relating to on the State forests, the mountain reservoirs, forestry instruction, irrigation, etc. In addition, 36 local mountain forestry conventions were organized, 56 special forestry shows in which the mountain industries were exhibited, besides displays of medicinal plants and common trees, etc. To this activity has been added that of publication of propaganda and scientific information. The number of these publications amounts to 149 of which 447,000 copies were issued, and periodical publications were also issued. The service of assistance and personal advice amounts to several thousand cases a year. In ten years more than 10 000 celebrations have taken place under the auspices of the Federation, which often distributed saplings, and has given 4000 diplomas and a thousand medals. Further details of the work of this Federation will be published in a special article written in *L'Italia Forestale* of the20 th of March, 1925.

708. **Proceedings of the "Società Agronomica Italiana".** — In a small publication No, 3 (years IV and V) ot the Proceedings of this Society have appeared, and are published by the Secretary, Prof. V. Rivera at irregular periods. The volume contains excellent articles amongst which are: Prof. Fridiano Cavara, The Botanical and agricultural work of Antonino Borzì; Prof. B. Grassi, The Anti-malarial work at Fiumicino; Prof. L. Pietri The

methods of investigation and the work of modern phytopathology; G. ALBO, Wheat in the county of Modica; D. BERTONI-CAMPIDORI, The radio-activity in agriculture; G. CATALANO, The organisation of the xerophils; A. CAUDA, Nitrates and nitrites in arable land; A. CAUDA, Rapid formation of humus; G. DE ANGELIS D'OSSAT, Leucite as a potash fertilizer, F. EREDIA, On the wheat climate of Sicily; G. MAYER, The technical equipment of the National Institute of Research on Agricultural Mechanics and its programme for the southern area; G. MUNERATI, The conservation of vitality of seeds in the deeper layers of the soil; L. PETRI, Observations on the morphology and the bacteria of *Pinus Halepensis* and *Pinus Cembra*; V. RIVERA, Influence of the atmosphere on root development of some herbaceous plants.

Besides these articles the meetings held in the year 1922-1923 are reported, as well as a large number of official and other notices. (*Atti della Società Agronomica Italiana*, No. 5, Years IV and V, 1924, Aquila).

709. **The Drought Commission of the Union of South Africa.** — The evidence submitted failed to prove that the average annual rainfall had changed in recent times, but that owing to deterioration of the veld, to soil erosion, etc. there was a reduced utility of rainfall. The main causes are overstocking of farms and veld-burning; the former deteriorates the fodder plants, and veld-burning seriously affects the run-off of water and assists soil erosion, a serious factor being the wind, which removes the unprotected surface soil. Owing to the rapid run-off excessive quantities of silt are being taken away bythe rivers.

Afforestation is advocated both as a source of timber and for the protection of irrigation catchements; irrigation works are being seriously affected.

Organised propaganda is recommended and the education of the farming community in order to improve farming methods.

Soil conservation is regarded as so vital a matter that it is suggested that a Department of Reclamation be instituted. (*South African Irrigation Department Magazine*, Vol. III, No. 3. pp. 152-153. Pretoria, 1924).

710. **Western Australian Forestry's Report.** — The report refers to the work of the administration from July 1, 1923 to June 30, 1924. Details are given of one of the successful periods of forestry administration of Western Australia. However, it is to be regretted that the forestry reserves in Crown land are rapidly diminishing owing to general cultivation. It is still undecided if the Government will definitely assign certain areas as forestry reserves. (*The Australian Forestry Journal*, Vol. VII, No. 1, 1925)

Congresses and Conferences.

711. **XII International Congress of Agriculture, Warsaw, 21-24 June, 1925.** — Application has been made to the Secretariat of the Congress for a full report of its proceedings, but as that is not yet available, it is not possible at present to state the final conclusions or the resolutions passed by the five Sections among which the work of the Congress was divided. (See *R.* n° 3, 462, 1925).

In the meantime the following account may be given of the main resolutions which accompanied the separate reports presented for discussion by Sections II, III, Va Vb, the work of which is cognate to that of this Review.

Section II : Plant Production. M. St. ZALINSKI concluded his report on the *use of gas and electric motors for agriculture*, by a proposal that the more extended use of these motors should be promoted by the establishment of electric workshops or of special schools and courses of instruction, that scientific research on the subject should be encouraged, and grants made to farmers, while the necessity of supplying combustibles at low rates should not be overlooked.

On the subject of *International phytopathological organisation* a communication was presented by MM. ET. JOEX and J. M. SAULNIER, who proposed, in regard to the projected *International Phytopathological Conference* that the programme of this Conference should be compiled by specialists, basing their recommendations on the final Act of the similar Conference of 1914, on the criticisms made of that Act and on the phytopathological legislation of the different countries. In addition, every nation should possess a State Service of Inspection for the protection of cultivated plants, organized directly for the purpose, and a sufficient number of Stations of Entomological Research and Plant Pathology, with proper provision of staff and equipment. Professor L. GRABOWSKI proposed the foundation of a periodical to be the organ of the International Association of the institutions for the protection of plants, and in particular to provide information on everything relating to potato scab. In connection with this disease Dr. A. KONECNY demonstrated the necessity for an International Convention and the establishment of an international commission with a view to the adequate solution of phytological problems of this character. Professor L. MOKRZECKI reported on the need for organizing in every country a service of protection of plants against harmful animals and weeds, and besides urging the training of an expert staff for the purpose, the establishment of chairs of applied entomology, and the standardising of legislation in the various States, he advocated the institution in each State of a Central Bureau of Plant Diseases caused by Insects, on the model of the Bureau of Entomology at Washington, which shall superintend all matters relating to the international control of animals and plants harmful to agriculture.

On the cultivation of lupins, reports were read by Dr. A. A. NEMEC, who explained the main questions which have still to be investigated in this connection, viz. lupins for seeding *versus* lupins for green manuring; the use of nitrogenous fertiliser or of ordinary manure, the exhaustion of the soil, and by J. SYPNIEWSKI on experiments with varieties with the shortest vegetative period, with hard seeds, with highest yield, showing absence of alkaloids, i. e. without bitter or poisonous substances.

On the economic use of phosphatic fertilizers according to the latest experiments important and detailed communications were made by M. BRUNO, Prof. E. GODLEWSKI Prof. D. PRIANISCHNIKOFF, Prof. J. STOKLASA.

Finally as regards the methods of drought control, M. H. KOCZOROWSKI reported on the necessity of artificial irrigation for intensive cultivation and especially for vegetable growing and dwelt at the same time on the need for framing exact estimates for such irrigation at the time it was undertaken. M. J. P. REBELLO made a communication to the Congress on the same lines as previously given in Portugal, in regard to the "integral" method of cul-

tivation of cereals, that is to say the amalgamation of different methods of cultivation of wheat as a hoed crop and in conjunction with another plant, with good results as a measure of drought control.

Section III. Animal Production. — The great importance of the local breeds from the point of view of the stock raising wealth of a country was the subject of exhaustive communications from MM. Prof. M. O. ARENANDEZ, E. WARNANTS, and J. BRAILA, who formulated conclusions for the preservation of the breeds. Prof. J. JESPERSEN, Dr. H. MALARSKI, Dr. G. V. WENDT, dealt in turn with the problem of the *feeding of cattle*, in relation to rachitism occurring in the animals, to pastures, and to the content of the feeds in protein, mineral salts and vitamines: Ing. N. GOUIN, M. ROZICKI, A. APPEL and Dr. A. SCHMID reported on the *feeding of dairy cattle* from the point of view respectively of the estimation of the nutritive value of the different rations by the KELLNER method, of their " milk yield value ", according to the method of NIELS HANSSON, of the Testing Associations and their records of milk production, and of experimental breeding.

The problem of *horse breeding* was dealt with from the point of view of war experience by H. de THEULEGOET and by Col. E. C, MEYSEY-THOMPSON; in relation to Polish stock breeding by M. F. JURJEWICZ. Proposals relating to stock selection and the simplification of the respective methods were brought forward by Prof. PRAWOCHENSKI, E. VIBBENS, Prof. S. ULMANSKY, with special reference to registration in the herdbooks.

With reference to pisciculture in stew ponds, R. DE DROVIN DE BOUVILLE proposes that there should be standard regulations as to the biological and chemical conditions of the ponds and their temperature; Professor O. HAEMPEL that there should be chairs or Experiment Stations established for pisciculture, M. E. RUDZINSKI that the piscicultural associations should make a stand against the reduction in price of pond fish, with a view to securing an adequate profit on their breeding; Dr. F. STAFF that the international commission on agriculture should take steps to compile international statitics on freshwater pisciculture and moreover that it should go on to standardize the technical methods of breeding, etc.

On the subject of *animal diseases and on epizootic diseases rom the point of view of international agreements for their control*, Prof. B. BANG and P. DECHAMBRE reported on tuberculosis; Prof. F. DE HUTYRA on tuberculosis, cattle plague, epizootic foot-and-mouth disease and contagious cattle pleuropneumonia, and Prof. S. MARKOWSKI on the standardisation of the control measures against epizootic diseases: while Senator A. MASSE proposed the immediate creation of a Permanent International Bureau for the Control of Epizootic Diseases, the drawing up of a standard type of veterinary healht report to be published at the same date in the various countries taking part in this Bureau, or the publication of an international health report. Finally H. DE ROC, referring to the establishment in Paris on 25 January 1924 of the *Office international des Epizooties*, laid emphasis on the conclusions adopted in respect of cattle plague and epizootic foot-and-mouth disease, at the *Conférence internationale pour l'étude des épizooties* held also at Paris in May 1921.

Section Va. Agricultural Experiment. — In this Section Dr. J. CHMELAR and C. SCHREIBER presented reports on the methods of collective experiments

over long periods, bearing testimony to the value of such experiments from the side both of theory and practice, while Dr. M. KOSTECKI made the proposal of inviting the International Union of Selected Seed Growers to publish periodically in their own organ the results of the comparative experiments carried out in different countries with varieties of improved plants. For the *international co-ordination of agricultural experiment*, J. JELINEK proposed in this connection the establishment of an international commission which should lay down the lines of the experiments to be made over a number of years, the standardisation of methods of research and an information service. For the international standardisation of methods of research the setting up of an Organising Commission was advocated by M. KOSINSKI, such Commission to consist of delegates appointed by the agricultural associations of France, Italy, Great Britain, Czechoslovakia and Poland.

Prof. MARCHLEWSKI and MM. J. JELINEK, J. POILVACHE and E. ROUX outlined the research work of the *Scientific Institutes for Agricultural Research*. In regard to *standardisation of the methods of analysis of fertilisers or of seeds*, Director K. DORPH-PETERSEN reported on the questions studied and the measures taken at the International Congresses on Seed Testing, held in previous years at Hamburg in 1905, at Munster-Wageningen in 1910, at Copenhagen in 1921, at Cambridge in 1924; Dr. W. J. FRANK reported on the standardisation of the testing methods; Dr. D. KNUTTEL on the method of the analysis of fertilisers; MM. E. VITEK and A. NEMEC on the establishment of an international commission which should standardise the methods of testing fertilising substances; Prof. B. ZALESKI on the testing of seeds from the point of view of international trade.

In this Section Mr. W. H. BEAL presented a communication on the *improvement of agriculture in America brought about by agricultural experiment*.

Section Vb. Agricultural Instruction. — Reports of a general kind were presented on the popularisation and diffusion of agricultural knowledge among the mass of the rural population by MM. P. C. CHANCRIN, S. JANKOWSKI, P. DE VUYST and M.me A. GRZYBOWSKA, dealing with the question in its various practical aspects, lectures, use of films, libraries, womens' farm organisations, etc. The subjects were then treated in more detail by MM. H. RADLINSKA, J. P. ZANEN, M.lle ROSINKIEWICZ, who dealt with the adaptation of primary school instruction, and of the curriculum of the training colleges for teachers to the needs of the rural population; M.me J. DZIUBKNSKA, Mr. R. MEYER and Drs. E. REICH and E. SAVOY dealt with the after school agricultural instruction; Dr. PRACH and M. SZYMANSKI with the vocational instruction of soldier agriculturists; Prof. S. PIETRUSZCZYNSKI and Dr. J. JELINEK with agricultural instruction in connection with the Institutes for Agricultural Research.

A report was presented by M. L. CHOMINSKI on the need for adapting the higher schools of agriculture to the requirements of the changed conditions of rural ownership, as due to the division of estates and the consequent institution of small independent agricultural units. MM. P. EVRARD, H. GIRARD and prof C. ROGOISKI reported on the organization of apprenticeship in agriculture.

The last reporter suggested that for period of apprenticeship, as an

experiment in education, the new programme of the Agricultural School re. cently founded and attached to the University of Milan, should be followed where a break in the studies is arranged after the fifth term and the time given to a practical apprenticeship of 9 months, during which period the pupil is under the supervision of the school and is obliged to draw up certain reports. A subsequent time of apprenticeship of 30 days falls between the sixth and the seventh term of school studies and a third period of 90 days between the seventh and the eighth term. For the apprenticeship are recommended good farms with a normal agricultural yield

Mention should be made of a report by M. W. HOCHBAUM on the measures taken to encourage agricultural progress in the United States by the Federal Department of Agriculture. Here is found a system of promotion of agriculture in its most varied forms, approved since 1914 by a Federal Law, adopted by the different States of the Union, and maintained by a fund of about 20 million dollars. The immense work which is carried on in this connection in the United States is accomplished by a staff of about 500 persons, of both sexes, who have special qualifications for work in connection with agriculture and who give instruction by demonstration methods to agriculturists.

A resolution was passed unanimously by the members of the Congress that the next International Congress of Agriculture (the XIIIth) is to be held in Rome in 1927.

712. **Argentine : International Congress of Social Economy**, Buenos Aires from 26 october to 4th November 1924. The *Museo Social Argentino* has published part of the reports of the Committee relative to this Congress, containing the decisions, recomendations and subjects discussed at the General Meetings (*Premier Congrès International d'Economie sociale*, organized by the "Musée social Argentin", under the patronage of the Government, pp. 80. Buenos Aires, 1925).

713. **France : International Timber Congress at Lyons September, 1925.** — The resolutions proposed for discussion concern the general methods of forest protection, particularly in respect to commercial and industrial interests of the timber trade in France and abroad.

Reports have been presented on the following subjects : Forestry utilisations, woods, forestry labour and forestry Associations; the use of pinetrees in the Landes ; transport of timber by railroad and sea ; the trade in colonial timber in France ; the Syndicates for the guarantee of forestry enterprises or works related to agriculture.

714. **Italy : International Road Congress at Milan, September, 1926.** — More than 50 States will take part in this Congress, which will be completed by an important International Exhibition on roads. The Exhibition will illustrate most progressive methods of constructing and maintaining roadways in towns and in the country. The methods of administration will be similar to those adopted by previous International Congresses (Paris 1908, Brussels 1910, London 1913). The Exhibition will be under the patronage of the Municipality, the Province and the Chamber of Commerce of Milan.

715. **Portugal : Science Congress at Coimbra, June, 1925.** — The Congress was organized by the *Asociación Española para el progreso de las Cien-*

cias in agreement with the Portuguese scientific Association. An exhibition of scientific apparatus was held.

716. **France : Congress on the Colonial Customs, Marseilles, June 1925,** organized under the auspices of the Colonial Institute at Marseilles with the object of studying the revision of the French colonial Customs system and how this revision could be applied.

717. **France. Congress at Grenoble of the " Associations Française pour l'Avancement des Sciences ".** 27 July-1 August, 1925.

718. **Algeria. Congress of Wheat Growers of Northern Africa, Algiers, 12 to 14 January, 1925.** — At the wheat Congress held in 1922 at Marseilles a form of contract for the selling of Algerian corn had been agreed upon. This Congress took place on the occasion of the French Colonial Exhibition under the auspices of the Colonial Institute of Marseilles and was attended by the National Mills Association and the " Fédération Intersyndicale de la Minoterie et de la Semoulerie " of Marseilles. The Congress of last January at Algiers was especially occupied with the problem of modifying the form of this contract.

719. **Italy. XIXth National Congress of Travelling Professorships of Agriculture, Rome, April, 1924.**

720. **First National Forestry Congress, Rome, May, 1925.**

721. **Conference on Agricultural Research, Rome, April, 1925.** — Amongst those present were : Prof. OTTAVIO MUNERATI, Director of the Royal Sugar-Beet Station of Rovigo ; Prof. ANGELO MENOZZI, Director of the Royal Technical School of Agriculture, Milan.

722. **Congress in Celebration of the 25th Anniversary of the Travelling Professorship of Agriculture in the Province of Syracuse; Syracuse, 5-7 April 1925.** — Papers read : The travelling Professorship of Agriculture for the province of Syracuse in the first quarter of a century of its foundation (Prof. N. DI MATTEI) ; The control of the white-red disease of acid fruits (oranges and lemons) (Prof. V. MEZZASALMA) ; Vineyard protection (Prof. S. MONTONERI) ; The improvement of yield of the carob tree (Prof. F. CASTRO) ; Almond-growing in Sicily (Dott. G. SAVASTANO) ; The importance of herbaceous plants in the Noto district, from a technical-economical standpoint (Prof. S. MARISCALCO) ; The meadows of Modicano in respect to the form and evolution of local cattle (Prof. V. PEDIGLIERI) ; The planting of oriental tobacco in the province of Syracuse (Prof. M. PICCITTO) ; Agriculture in the province of Syracuse (Prof. S. ODIERNA) . For information apply to the : Cattedra Ambulante di Agricultura, Syracuse (Sicily).

723. **000. Italian Wine Day at Milan, April 24, 1925.** — This Day was organised by the Commission for the Protection of Italian Wine, on the occasion of the International Sample Fair. The chief speakers were : Professor L. MESSEDAGLIA : Exaggerated medical and hygienical measures against the use of wine ; G. BIONDI : Propaganda and publications in favours of Italian wine ; Prof. MARESCHALCHI : The necessity of propaganda and protection abroad for Italian wines.

724. **Italian Winemakers Day, Milan, 22 April, 1925.** — Amongst the papers read were : Enology and the consequences of reforms in technical schools for wine making (DE ROSSO, Specialist in wine-growing). Technical specialists in the association for the protection of wine-growing (Prof. A. MORETTI). The

technical wine specialists in thesociations and in the wine cellars of the Associations (A. DA RIOS).

725. **Italian Wine** **nference. Milan, 20-27 April 1925.** — This Conference took place ome occasion of the International Sample Fair and under the auspices of t" Unione Italiana Vini ". The papers read included Credits on wines, andooperation (G. FRIEDMANN); Duties, Customs and taxes, (Doct. L. BRANCONI); Legislative measures relative to fraud and typical wines (Prof. TEDESHINI); Transport by reailroad and sea (Avv. C. CAVAZZANA); Export of winF. FOLONARI); Customs treaties and new markets (Prof. A. MARESCALCI"

726. **Vth Meeting of the Italian Association for the Progress of Scie, Pavia, 24-28 May, 1925.** — Among the papers read on agriculturscience were the following: Light as a detrimental factor of plant life of. G. GOLA); Libian flora (Prof. F. CAVARA); Rice-growing from an economical point of view (Prof. N. NOVELLI); Artificial Lakes (Prof. G. GANASSINI) For information apply to the Istituti Biologici (Palazzo Botta), R. University, Pavia.

727. **Mexico: First Congress of Stock Breeding and Veterinary Hygiene, Mexico, 8-28 November 1924.** — The Congress was divided into 3 Sections: Stock breeding, sanitary hygiene and medicine. In a general meeting the following subjects were discussed: tuberculosis, epidemic foot-and-mouth disease, piroplasmosis, compulsory vaccination of dogs against rabies, the vaccine-serotherapy against swine cholera; nutrition of milch-cows and sanitary laws relating to cattle. Papers were read also by Dr. D. FERNANDEZ, Professor of Pathology at the School of Veterinary Medicine of Mexico on the curing of mastitis of dairy cows, and Dr. S. MACIAS VALADEZ on the chief parasitical skin diseases.

Exhibitions, Fairs, Competitions.

728. **Germany: International Fair at Frankfort; Spring Meeting 1925. General Fair from April 19-25; Technical Fair from April 12-22, 1925.**

729. **Argentine. IVth International Livl Stock Show at Palermo, Argentine, September, 1924.** — This exhibition was organised by the *Sociedad Rural Argentina.* The annuals of this Society published a special number (No. 19, October 1924) for this Exhibition in which are shown excellent illustrations of the cattle exhibited.

730. **Switzerland: International Fair of Colonial and Exotic Products, Lausanne, from 27 June to 12 July, 1925.** — The Exhibition was divided into 6 sections: I. the food products of agriculture and of the sea; II. non-food products of agriculture and of the sea; III. horticultural, arboricultural and allied products; IV. forestry products; V. subsoil products; VI, Miscellaneous, Colonial arts, etc.

731. **Germany: Sugar-Exhibition, Magdeburg, 23 May to 7 June. 1925.** organised by the " Vereins der Deutschen Zuckerindustrie " together with the " Verein deutscher Zuckertechniker ". The Exhibition took place on

the occasion of the 75th anniversary of the "Verbände der deutschen Zucker Industrie". During the Exhibition period the chief German Associations connected with the sugar industry held Congresses at Magdeburg.

732. **Argentina: Cotton Congress, Corrientes, September, 1924.**

733. **IIIrd Agricultural Exibition; Competition for Dairy Cows; Exhibition of Pure Seeds; Argentina, 18 to 26 April 1925,** organised by the *Sociedad Rural Argentina.*

734. **United States: A Rubber and Tropical Products Exhibition** will be held at Boston, Mass. from October 10 to 17, 1925. Sections will be devoted to rubber, textiles, coffee, cacao, tea, vegetable oils, fats and waxes, hides and tanning materials, sugars, fruits, timber and dye woods, minerals, touring and travel. (*Bulletin of the Pan-American Union,* Octor, 1924).

735. **United States: National Exhibition of Chemical Industries, New-York from 28 September to 3 October, 1925.**

736. **Cuba: Stock Breeding Exhibition, Havana, 1926.**

737. **Poultry Exhibition, Havana, Cuba, February, 1925.**

738. **Tunisia: General Exhibition of Horticulture and Forestry, Tunis, April 1925.** — The Exhibition consisted of two divisions: horticulture and forestry. The last group was organized by the aid of the "International Society of Tree-friends" at Tunis, and was divided into three sections: seeds and plants; forestry products; publications on forestry matters.

739. **France: General Competition of Autocars and Gas-generators, France, 15 September, 1925.** organized by the *Scientific Petroleum Commission* under the patronage of the "Office National des Combustibles liquides", the "Office National des Recherches et Inventions," the "Automobile Club" of France and the Ministry of War. A Special Committee was appointed for the preparation of the programme, with M. KOENIGS (Member of the "Institut" and Professor at the Faculty of Science, Paris) as President. The competition was held in the North of France and covered a distance of 200 kilometers.

740. **Italy: Competition for the Smaller Agricultural Industries and Manufactures of Italy.** — The Institute for Small Industries, at Bolzano, has given notice that a prize competition has been opened for small rural industries and manufactures, under the protection of the Royal Venetian Institute of Science, Letters and Art.

For information apply to the R. Instituto Veneto di Scienze, Lettere ed Arti, Bolzano, Piazza Domenicani, 1.

741. **Uruguay: Exhibition of Agricultural Products. Montevideo, 19 June, 1924.**

Development of Agriculture in Various Countries.

742. **Germany: The Situation of German Agriculture at the beginning of 1924.** In a report presented in February 1924 by the German Government to the Experts-Commission, a section of the Reparations Commission, statistical information was given respecting the economic-financial situation of Germany (Material für ein Studium von Deutschlands Wirtschaft, Währung und Finanzen). For the work of the Experts Committee

further details on the agricultural situation of the ex-Empire proved necessary and these were furnished by the German Agricultural Council (Deutsche Landwirtschaftsrat). These notices formed the second number of the publication of the Agriculture Council (Veröffentlichungen nº 2). The publication is divided into 8 chapters, the first of which is an introduction by Dr. BRANDES, Economic Adviser and President of above Council; the second chapter contains the Statement which Baron von WANGENHEIM KL. SPIEGEL President of the Official German Agricultural Commission had already presented to the irst Commission of Experts. This Statement has served as a basis for collection of data; a third chapter treats of food conditions in Germany, which had been discussed by the Economic Adviser before the 1st Commission of Experts. The following five chapters give a general description of the condition of German Agriculture at the beginning of 1924; the productive capacity of German Forests according to the German Forestry Council (Reichsforstwirtschaftsrat); the output of German Farms from the year 1914; agricultural Capital and Credit in Germany; the agricultural fiscal taxes.

The publication forms a complete statement, illustrated with diagrams and figures, of the conditions of German Agriculture especially in the first five years after the War (Materialien zur Beurteilung der Lage der deutschen Landwirtschaft zu Beginn des Jahres 1924. Vorgelegt bei der Beratungen der Vertreter der Landwirtschaft mit der 1. Internationalen Sachverständigen Kommission am 11ter Februar 1924. *Deutscher Landwirtschaftsrat.* Veröffentlichungen nº 2, pp. 51, 8º; diagrams. Berlin, 1924).

743. **Brazil: Official Data on Brazilian Agriculture.** — The volume contains data supplied by the Brazilian census of September 1920 in respect to agriculture and industry in the Federal District. This publication, the 2nd part of Vol. II of the complete Statistics of the census, contains in regard to agriculture the following data: the areas and value of farm properties, the class of farmer and nationality of the owners, the systems adopted on the farms, the number of cattle, the agricultural, forestry and cattle production, rural machines and implements. Coloured plates show the types of poultry reared in the districts of Engenho Novo, Engenho Velho e Jacaperagua (Orpington and Rhode Island breeds, etc.)

(Ministerio da Agricultura, Industria e Commercio, Recenseamento do Brasil realizado em 1 de Setembro de 1920, volume II, part 2ª, Rio de Janeiro, o 1924).

744. **United States: The National Forest Reserve of New-Hampshire, U. S. A.** — The *National Forest Reservation Commission* has added 21000 acres to the *White Mountain National Forest.* The Governmental Forest Reserve now contains 462,200 acres, representing an investment of $ 70,000. It is proposed to increase the area to 960,600 acres. (*Science*, vol. LXI, No. 1581, 1925).

745. **Sudan: The Development of Cotton-Growing in Anglo-Egyption Sudan.** — The work has been completed for the Makwar dam on the Blue-Nile near Sennar (Anglo-Egyptia Sudan) in connection with the irrigation of large areas of land for cotton growing. Drainage works are also being completed in the Gesira plain. The Makwar dam will have a length of 3025 metres. The reservoir will have a length of 80 kilometers. The canal

made through the Gesira plain will have a lenght of 15,000 km. Thus altogether an area of 3000000 *feddan* (1 feddan = m^2 4200.83) will be irrigated. The cost of this important enterprise hasn bee estimated at £. 13,000,000. The development of the irrigated area will be chiefly undertaken by the *Sudan Plantation Syndicate*. The Sudan Government and the native growers will take part in this development. Pending the completion of the work about a fifth of the area has abready been planted with cotton. The water is supplied by suction pumps. (*La Dépêche coloniale*, November, 1925, and *Bollettino di informazioni economiche del Ministero italiano delle Colonie*, year XII, No. 6, 1924).

746. **East Africa: Tea Enterprise in Kenya Colony.** — Tea planting on a commercial scale is now taking place in Kenya Colony. two large firms have purchased estates in the highlands, at Kericho and Limoru. The Limoru firm proposes to make agreements with estate owners, who will receive tea seed and expert assistance; the firm will receive the produce for fifteen years, and will manufacture and dispose of the finished tea(*East Africa*, Vol. I, No. 5, p. 140. London, 1924).

747. **Australian Irrigation Scheme.** -- The first section of the Dawson Valley irrigation scheme has been officially opened by the Governor of Queensland. The dam will have a lenght of 860 feet; the reservoir will have a storage capacity of 2,485,000 acre-feet and will supply water for 200000 acres of agricultural and 2 000 000 acres of pastoral land, all of which is at present unused. The cost will exceed £.2 000 000. A hydroelectric station at the dam will generate power to supply light, power and water for the whole area. (*New Reclamation Era*, Vol. 15, No. 10, Washington, D. C., 1924).

748. **Italy: Improvement of Grasslands and Pastures of Mountain Communities in Italy.** -- The problem of improvement of forestry properties of Mountain Communities may been greatly assisted by the favourable conditions granted by the Royal Decree of December 30, 1923. On behalf of many communal administrations the "Italian Communal Association" has approached the principal credit institutions in Italy, asking for financial assistance for carrying out the projects relative to the improvement of grassland. The communities interested are undertaking these improvements on their own initiative or through the *Secretariat of the Mountains* (Segretariato della Montagna). (*L'Italia Forestale*, Year VII, No 13, 1925).

749. **Russia: Agricultural Progress in Russia.** — A paper read by M. A. I. RYKOV at Tiflis at a meeting of the *Central Executive Committee of the Union*, gives an account of the restoration of Russian Agriculture. The area sown in 1923-24 was 80 % of that sown before the War, in the Ukraine it even amounted to 97.5 % and in Siberia 96.1 %. It is due to the famine of 1921 that the area sown has not fully reached the pre-War standard. It is important to note how Agricultural progress in the year 1923-24 has been chiefly connected with crops having the highest market quotations. Similar improvements were also noted from a stock-breeding standpoint. For instance, in 1924 the number of horses was 70.8% of that 1926; the number of cattle 93 %; sheep 83 % and pigs 87 %.

The Government has spent 85 million roubles for the support of agriculture in the areas where the harvest was poor. The harvest of 1924 was only one-

quarter less than the harvest of 1921. Great care had been taken to provide the peasants with a sufficient quantity of seed in the spring and in the autumn. Unfortunately the weather conditions in the winter spoiled the autumn crops. The Soviet Government has therefore given an additional subsidy of 7,500,000 roubles.

In connection with the progressive consolidation of the Russian finances there will be a partial remission of agricultural taxation and schools for agricultural instruction will be increased. In his description of the rural situation, RYKOV remarks on the progress in the economic and intellectual conditions of the peasants. The Government has undertaken to direct the rural affairs and to take part in the activity of the local Soviets, and also in the co-operation of agricultural producers and consumers. (*The Soviet Union Review*, Vol. VII, N_0 12, 1925).

750. **Czecho-Slovakia: Note on Czecho-Slovakian Agriculture.** — *Seed selection* is carried out successfully by individuals as well as by the Government. The Government lays much stress upon the production of pure seed, and controls the seed trade, and organized Experimental Stations, such as the Moravian Experimental Institute at Brno, the Experimental Station at Dobrovice the Sugar Experimental Institute at Prague, etc., and others are being organized. *Horticulture :* The output is considerable in the valleys and on the plains.

Large quantities of vegetables such as garlic, cauliflower, tomatoes, etc. are imported. Preserved tomatoes and vegetables are made only for home consumption. *Fruit-growing :* As the output largely exceeds the demands of home markets, there is an important fruit-export. The heavy output, together with the large national sugar production have brvought about an extendsive industry for fruit preserving, jams, etc. (about 325 factories).

Flax and Hemp : Not yet fully developed; about 500 factories, the most important of which are: the factory at Kuchelna (largest in Central-Europe) and that of Jindhichův Hradec.

Hop growing : the hops of Zâtec-Saaz are well known. A law regulating the exportation of this hop has been passed. The production amounts to 400 000 420.000 q. per year and the annual exportation varies from 30 000 to 70 000 q.

Tobacco-growing is not of great importance, but the area has increased from 1254 hectares in 1921 to 4.152 hectares in 1924.

Floriculture has improved, expecially during the years of the War. New firms have been established for flower growing, chiefly for export. The gardens ot Pruhcnice near Prague and those of Mlynany in Slovakia are well known.

Forestry : Checho-Slovakia is one of the most heavily forested countries of Europe (4,663,663 hectares of forest cover 33 % of the total area the country). The timber production amounts to about 15000000 cu. metres. There are 800 modern saw-mills driven by steam or electricity and 1853 hydraulic saw-mills: 640,000 cu. m. of timber are exported. The greater part of the forests are private property but the Government is preparing a scheme of forest nationalization.

Food-product industries : Besides fruit, vegetable and canned meat, there are factories for the preparation of preserved pickles, fish, chocolate, etc.

Potatoe-industry : Carried on chiefly in the higher plains. Distilleries, starch-factories, etc. are mostly cooperative industries.

Distilleries. — Number about 1000 and are connected with the farms that supply the raw material (especially potatoes) to which are returned the waste products. Here are also about 70 industrial distilleries that produce ethyl-alcohol from molasses, maize, etc. The total annual supply of alcohol is regulated by the State, and amounts to 50 0000 hectolitres. As the production of alcohol is excessive the Ministry of Finance has prohibited the manufactur of fruit-alcohol.

Malt Industry : The growing of barley and the improvement of this cereal has received much attention. The malt industry has 176 factories which annually deal with 400 00 q. of barley (20 % of this is home grown). (*Publication du Ministère de l'Agriculture de la République Tchécoslovaque,* Prague, 1 March, 1925).

Miscellaneous.

751. **The Worlds Rubber Position.** — A concise pocket manual containing statistics relative to each country's import and export of rubber ; directory of merchants, brokers, dealers and manufacturers ; market prices, average fluctuations, etc. (Published monthy, by W. H. RICKINSON and SON, 3 Great Winchester Street, London, E. C. 2.)

752. **The Anti-opiumActivities of the League of Nations.** — In the International Meetings called together by the League of Nations in order to limit the production of alkaloids, a proposition, presented by the French and British Governments on the limitation of the use of opium in the next 15 years has been adopted. The agreement was signed by the following States : France, Great Britain, Italy, Japan, Holland, Portugal and Siam.

The second meeting on opium suggested a scheme for protocols to regulate the production, supply and export of opium. (*Résumé mensuel des travaux de la Société des Nations,* February and March, 1925).

753. **New Process for Removal of Acid from Oils and Fats.** — By this process oils are treated with a compound which rapidly separates the constituents of the oils into two groups, viz: neutral oil and fat, and fatty acids. The treatment is carried out in aclosed apparatus. The cost of the above-mentioned compound is higher than that of an alkali which serves for the removal of acids from oils of law acidity. The new process requires the employment of steam, the expense of which may be compensated by the saving effected in deodorization, which will require much less time in this case than when an alkali is used for the removal of acids. In this way the capacity of the deodorization machines now in use would be very much increased. The cost of installation of this process is however very high and would therefore only be suitable for refineries that use oil with a high percentage of fatty acids. (Communication received by the International Institute of Agriculture).

754. **A German Agricultural Delegation in the United States of America.** — This delegation left Bremen on April 2nd for the United States in order to study agricultural conditions of the last ten years. The Commission will stay in the United States for about 6 months and is composed of the following delegates: Dr. F. BRINKMANN, Professor of rural economy at Bonn ; Dr. F. ROEMER, Professor of plant genetics at Halle ; Dr. KÜHNE

specialist in farm engineering ht Munich and J. DEICHE a land owner and ex-Director of the stock-breeding section of the G.rman Ministry of Agriculture. The delegation will be officialy accompanied on its tour by the Under-Secretary of Agriculture. Dr. F. HAGEDORN, appointed by the Department of Agriculture at Washington. (*Science*, VolLXI, No. 1580).

755. **Brazilian Oil Palms.** — Sig. ARMANDO MENDES has published a study on these palms (more than 40 varieties) in the *Brazil-Ferro-Carril* of the present year. The possibilities are shown of the oil-industry in Brasil. Most of these trees were derived from the States of Amazona, Pará, Maranhão Piahuy, Bahia, Pernambuco and also trom Minas Geraes, S. Paulo, Rio de, Janeiro, Alagoas, Rio Grande do Norte and Matto Grosso.

The author considers especially the "babasou" (*Orbignia Martiana*, Barb. Rodr.); the "bacaba" (*Oenocarpus distichus* Mart.); the "bossu" (*Maricaria saccifera*, Gaertn.); the "burity" (*Mauritia vinifera*, Mart.); the "Carnauba" *Copernicia cerifera*, Marth. and *Corypha cerifera*, arruda); the "Curnà" (*Attalea spectabilis*, Mart.); the "dende" (*Elalis Guineensis*, *Laeq.*); the "inaja" (*Maximiliana regia* Mart.); the "inayuca" (*Maximiliana speciosa* Mart.); the "inadaya" (*Attalea humilis*, Mart.); the "Farina" (*Phytelephas Macrocarpa*, Buiz and Pav.); the "pasciuba" (*Iniartea Orbigniana or I exorrhiza*, Mart.) the "piassava" (*Laopoldina Piassava*, Mart. and *Attalea funifera* Wall); the "pindola" (*Attalea Compta*, Mart.); the "tucuman" (*Astrocaryum Tucuman*, Mart.) and the "urucury" (*Attalea excelsa*, Mart.) (ARMANDO MENDES Palmeiras do Brazil productoras de oleos. Grandes possibilidades para esta nova industria. *Brasil-Ferro-Carril*, Year XVI, Vol. XXVIII Nos. 381, 382, 383 384, 385, 386, 1925)

756. **Brazil: Report on the Progress of Agriculture in Brazil** — Dr. DEOCLECIO DE CAMPOS, Brazilian Delegate at the International Institute of Agriculture in Rome, has taken the initiative in describing the progress of Brazilian Agriculture, with a view to improving the relations between the above Institute and Brazilian scientific men, specialists in agriculture and economists. Dr. de CAMPOS has arranged that monographs, essays and original articles on one of the many technical and scientific questions of agricultural economy, written by Brazilians, should be forwarded to him. Such works will then be examined by competent officials of the International Institute of Agriculture, after which they will be brought to the knowledge of wide international circles interested in agriculture, by publication in one of the reviews of the International Institute.

The problems selected will treat of the various aspects of Brazilian agriculture and will be either of general character (irrigation, the use of fertilizers, experiments in agriculture, forest reserves) or of a more special type (oil plants, medicinal plants, cotton, growing, rice, rubber-planting, sugar, manioc, cattle breeding, food-stuffs industries. (*Brasil-Ferro-Carril*, Year XVI, Vol. XXVIII, No. 391, 1925).

757. **Meat and Coffee and their Relation to the Export-Trade of Brazil.** — Dr. ALFONSO COSTA, Director of the *Serviço de Informações del Ministerio de Agricultura, Industria e Commercio* of Brazil has published a study on the export of Brazilian products to France, Great Britain and Germany. The important chapters of thes study are those that treat of coffee and of

meat. The chapter on coffee, which contains statistical data, points out how France and Germany promise to become excellent markets for this Brazilian product, while the import of coffee to Great Britain has diminished. It is to be noted however that the import of coffee of other than Brazilian origin has diminished on the British markets.

In the chapter on the frozen meat trade Dr. COSTA gives a comparative study of the world-consumption of this product. It is however stated, that the Argentine Republic takes the first place on the French, British and German markets as to frozen meat. But after coffee, frozen meat is of the greatect interest for the Brazilian export-trade to France. On the British market however it cannot compete with Argentina, Australia and Uruguay. The export of meat to Germany has only been carried out since 1921, but this country promises to become a good market for this Brazilian product. (ALFONSO COSTA. Exportação de carnes. *Ministerio da Agricultura, Industria e Commercio. Serviço de Informações*, pp. 12, Rio de Janeiro 1925; *idem.* O café. *Ibidem:* pp. 22. Rio de Janeiro, 1925).

758. **Hygienic Organization in Brazil.** — A report has been presented by Dr. MARIO PINOTTI, of the "Sanità Pubblica" of Brazil to the "Accademia di Medicina" in Roma. The author gives a short description of the progress made by the State in the field of social medicine. The development of the present work on hygiene in Brazil is largely due to the fact that the Manguinhos Institute is one of the chief centres of medical research in South-America The Rockefeller Foundation has also given encouragement to the organisasation of Brasilian Hygiene. In 1918 under the Government of EPITACIO PESSOA the "Departemento Nacional da Saude Publica" was founded. This Department consists of three divisions the, (1) maritime (2) land and (3) rural. The last one has an economic-social importance. The expenses, for the organization of hygiene are covered, one half by the Provinces (which are self-governing) and the other half by the Central Government. The budget for each province will probably amount to 1400000 lire yearly. In 1924 the Direction for rural hygiene functioned in 18 Provinces and in the Federal District and a sum of 26600000 lires was expended. The Federal Government nominates the Chiefs of the Service and their assistents. The Commission delegated by the Division for rural hygiene to each province begins with the preliminary work of distributing sanitary information to each community. The data collected form the basis for a classification of these Communities in respect to their sanitary and economic conditions. The funds available allow a certain number of communities to be provided with the necessary sanitary establishments that are fitted up as prophylactic stations. The staff appointed to each establishment is composed of: a chief Doctor of medicine, a microscopist, a secretary, an attendant and as large a number of nurses as possible for visiting purposes.

Dr. PINOTTI discusses what has been accomplished in Brazil, especially in respect to malaria, anchylostomiasis and venerial diseases.

(Dr. MARIO PINOTTI. The Brazilian Hygienic Organization. Report presented to the Academy of Medicine, Rome, at the Meeting held 28 February 1925, 21 pp. Rome, 1925).

759. **Brazilian Inquiriy on the Increase of Prices.** — In the *Gazeta da Bolsa* (Year VIII, No 6, Rio de Janeiro, 1925) an account is given of the decisions made and which were sent to the Inquiry-Commission of the " Associação Commercial do Rio de Janeiro " on the increase of prices in Brasil. The questionnaire and the answers discuss the following subjects : technical questions, rural sociology and economy, agricultural and cattle breeding instruction, development of stockbreeding, agricultural credits, division of the soil after the North-American and Argentina system, importation of agricultural machinery, model-farms, installation of refrigeratories, bread making, fishing and hunting regulations, small regional markets, regulation of national and foreign immigration and reorganisation of the Military Service in respect to the agricultural requirements

760. **The Metric System adopted by Canada.** — The metric system was officially adopted by the Canadian Government in July, 1924. A period of ten years has been allowed for the education of the public in the use of the system. In the meantime the Government will use the new system in their official figures and statistics. (*South African Journal of Industries*, Vol. VII, No 12. Pretoria, 1924).

761. **The British Sugar Beet Industry.** — As a result of the beet sugar subsidies the following companies have been formed : The Ipswich Beet Sugar Factory Ltd., capital £. 300 000, to serve growers in South Suffolk and Essex ; capacity, 1200 tons of roots per day ; ready in October 1925. The West Midland Sugar Co. Ltd., will erect two factories, each of which will deal with at least 1000 tons of roots per day; allowing for working capital, the cost of each factory will be £. 500 000. The Bury St. Edmunds scheme, half the cost of which (about £. 350 000) will be subscribed by Hungarian capitalists, will have its factory ready for the 1925 season ; the factory capacity will be about 1500 tons of roots per day. (*The International Sugar Journal*, Vol. XXVII, No 313, London, 1925).

762. **An Improved Method of Transplanting Young Trees.** — *The South-African Journal of Industries* (No. 2, vol. VII, 1924) describes a method for transplanting young trees in order to avoid damage from the sun and so that it will not be necessary to water them excessively when transplanting. Mr. J. A. GRANT from Duivel-Kloof in the Transvaal has invented a machine called the " Duivel Tree Planter " which works on the following principle ; the earth around the young plant in the nursery is removed, together with the young tree and is then transported without damage to the roots. The method is to place a cylinder (driven down completely to the roots) around the young tree and then to transport the cylinder and tree to the site chosen for the replanting.

763. **Land Reclamation in Italy.** — During the discussion on the Finances of Public Works in the Senate, Minister GIURATI has declared that land-reclamation is particularly important for Southern-Italy. Works of this nature carried out up to the present time amount to 332 000 hectares, and a further 12 200 000 hectares are being improved, or are in a state of advanced preparation. These reclamations will cost 1683 million lire. Besides the work completed, reclamation projects for another 112 000 hectares are being con-

sidered nd it is expected that requests for a further 202 000 hectares wille folow.

764. **Internal Colonization in Italy.** — In the periodical *La Terra*, the Hon. Senator EDOARDO PANTANO has published two articles on internal colonization. Senator PANTANO is an authority and an advocate of internal colonization. In the first of his articles the points out the economic, financial and administrative basis of a "National Institute for Internal Colonization". The project for this Institution as it has been presented by Sig. PANTANO to the Italian Senate, was published almost in full in the last edition of the present Review. In the second article the author presents ideas in favour of facing the land problem in Italy, as it has already heeen done in other countries. The results of the Inquiry by the Ministry of Agriculture in 1917-1921, although they were incomplete, state that in Italy large estates are gradually being converted into small holdings. But in order to expedite this transformation and to develop rural co-operative movements, co-operative leasing of land, individual reclamation, etc. it is necessary to obtain the support of the Government (EDOARDO PANTANO, "La Colonizzazione interna". *La Terra*, Year 1, No. 3, 1925. "L'Esempio degli altri in Tema di colonizzazione interna". *La Terra*, Year 1, No. 4, 1925.

765. **Holland : Tea Planting in the Dutch-Indies during a Century (1824-1924).** — On the occasion of the Tea Congress and Exhibition at Bandoeng the Tea Experimental Station (Proefstation voor Thee) published a retrospective monograph on tea planting in the period 1824-1924. (*De Indische Mercuur*, Year 48, No. 10, 1925).

766. **Roumania : Monograph on Agricultural Costing.** — The Inspector General of Agriculture of the Roumanian Ministry of Agriculture, P. ROSIADE, has written a monograph on agricultural costing, which is a practical publication of about 70 pages, divided into two sections. The first chapter deals with the nature and origin of agricultural costing, development and organisation, importance from a scientific point of view, the use of statistical book-keeping and the practical application of book-keeping methods. The second chapter treats of agricultural costing in different countries. Then follows a description of the organization of the Institute of Rural Accountancy and Economy of Czechoslovakia, together with details of the models and methods employed by this Institute. (P. ROSIADE. Oficine de Contabilitate Agricola' Expunere monografica Ministerul Agriculturii si Domenilor *Directia Statisticii Agricole, sia Publicatiilor Supplemento a Bulletinul agriculturii*, Vol. IV, pp. 71, Bucharest, 1924).

767. **France: Cyanamide Production in France.** — In 1923 cyanamide was produced by three establishments (Bellegarde, Marignac and Brignaud)e In 1924 more factories were established and it is estimated that the total output of French cyanamide in 1924 amounted to about 90 000 tons, equal to 18 000 tons of nitrogen. (*Industrial and Engeneering Chemistry* Vol. 17, No 1, 1925).

768. **Morocco : The Sale of Morocco Phosphate in 1924.** — The sale of phosphate amounted to 430 340 tons, halfof which was taken by France and Spain (respectively 113 476 and 108 564). Then follows Holland with about 80 000 tons, Denmark 33,000, Belgium 11,000 tons. Other European States

have imported considerably smaller quantities. (*Rassegna mineraria metallurgica e chimica*, Year XXXI, Vol. LXII, No. 2, 1925).

769. **France : Protection of Antartic Fauna.** — The French Government has issued a decree for the protection of antartic fauna in a " National antarctic Reserve " in territories belonging to France, on the Islands of Crozes, S. Paolo and Amsterdam, and in northern and southern Kerguelen Land on some small islands. Within the boundaries of these areas the killing of whales, seals, etc., is prohibited. No special measures are taken for enforcing this decree, which depends entirely on the good faith. of the fishermen in these seas. (*Nature*, Vol. 115, Nº 2893, 1925).

770 **Portugal. The Discovery of the Alkaloïds in Quinine.** — In the *Revista della Chimica pura e applicada* (Nos. 5, 4, 6; 1924), the organ of the "Sociedade quimica portuguesa" is an article of Prof. ALBERTO DE AQUIAR, devoted to the memory of Dr. BERNARDINO ANTONIO GOMEZ, a Portuguese medical doctor who lived from 1768-1823. In the year 1812, 8 years before quinine was discovered by PELLETIER and CAVENTON, he published an article in the *Memorias da Academia* (Vol. 3, 1812) entitled " Ensaio sobre o cinchonimo e sobre a sua influencia na virtute da quina e de outras cascas ". The discovery of GOMEZ was also published in the British Press of the time. The basic qualities of the cinchona tree, indicated by the Portuguese doctor were then examined in the laboratory of THÉNARD and communicated to PELLETIER and CAVENTON. During the years 1905 and 1911 the "Academia Real das Sciencias" has received information regarding GOMEZ, from Visconde DE VILA MAIOR and Dr. EDWARD AUGUST MOTA.

771. **Nitrogen Fixation in Czechoslovakia.** — The Government proposes to erect new factories for the fixation of nitrogen in the centre of the country, as the present factory at Falkenau, directed by the "Aussig Chemische Verein" is very near the frontier. A Ministerial Commission has proposed to increase the working capacity of the factory at Falkanau to 30 000 metric tons of fixed nitrogen annually in order to supply the requirements of agriculture. The Commission also proposed that a factory be established at Mahrisch-Ostrau for the preparation of sulphate of ammonia from the by-products of coal gas and of the by-products from the fixation of atmospheric nitrogen. The creation of a hydro-electric establishment for fixation of nitrogen is proposed at Shechowik (*Chemistry and Industry*, Vol. 44, No. 17, 1925)

Journals and Reviews.

772. **Germany.** — The *Illustrierte Landwirtschaftliche Zeitung* has published a special number on potatoes (No. 11, 1925). This *Kartoffel Sondernummer* contains articles by Dr. L. W. RIES on the use of implements in weeding; by the agricultural expert G. SCHALK on the possibility of doubling the yield of potatoes; by Prof. APPEL, Director of the State Biological Institute at Berlin-Dahlem, on the measures for prevention of abnormal sprouting of the potatoes; by Prof. Dr. O. HEUSER on the degeneration of potatoes and preventive measures; O. STAUDTE, of Breslau on the Fertilization or Pollinization of the Potato flower; by Dr. NICHTWEIS, agricultural adminis-

trator in Silesia on the methods of storage of the potato by the construction of special store-houses; by Prof. OPITZ of the High School of Agriculture in Berlin, on the influence of fertilizers in potato-planting. In addition there is an article by Herr KNORR of Vornstedt (Mark) on the annual report of the German Potato Research Station (Deutsche Kartoffelkulturstation) and the results reported therein concerning the inquiries of that Station during the year 1924; an article by H. MORGEN of the Agricultural Institute of Giessen on the percentage of starch in relation to the successive production of the same variety of potatoes through succeding generations; by Mr. KOHLMEIER of Mecklenburg on the determination of the forms of tubers of potatoes. The articles are illustrated. The usual supplement to the *Illustrierte Landwirtschaftliche Zeitung*, the *Blätter für die deutsche Hausfrau* is also devoted to potatoes in this number.

773. **The "Deutsche Bergwerks-Zeitung"** has recently entered its 25th year and has issued special illustrated publications with detailed information on German steel mining industries. The first numbers of this special publication give a survey of the German mining industry.

774. **The "Kolloïd Zeitschrift"** the organ of the German Colloid Association, has published a volume in the honour of Prof. RICHARD ZSIGMONDY'S 60th birthday. This volume contains articles by the most well known specialists on the chemistry and physics of colloids. It is excellently illustrated by tables and contains a photograph of Professor ZSIGMONDY. (*Jubelband der Kolloid-Zeitschrift*, Organ der *Kolloid-Gesellschaft*. Unter Mitarbeit von Freunden, Verchrern und Schülern herausgegeben von W. BACHMANN und W. OSTWALD. *Ergänzungsband zu Vol. XXXVI der Kolloid Zeitschrift*, pp. 390, figs. and tables. Dresden 1925).

775. **"La Colmena".** — This periodical has been edited since January 1, 1925, by the Spanish apiculturist Sig. NARCISO J. DE LINAN Y HEREDIA, who has edited for four years a section entitled "La Colmena" (the Bee-Hive) in the "Revista Social y Agraria" and has transformed this section into a separate Review.

776. **The "Boletin de Agricultura técnica y economia"**, official organ of the "*Dirección general de Agricultura y Montes*" in Spain, will have a special section for information supplied by the International Institute of Agriculture, Rome.

777. **"El Progreso agricola y Pecuario"** treats in the February 28 issue (No. 1380), of the Wheat Conference which took place at the end of February in Madrid. The importation of wheat into Spain is discussed, and the national regulations and fiscal measures.

778. **"La Vida Agricola".** — Founded some years ago, this Catalanian periodical opened last October a new series of publications.

The "Unión de Viticultores de Cataluña" has combined its two reviews "Avene Agricole" and "Vida Agricola" into one periodical, under the title of the latter. It is a monthly publication with many illustrations and is published by FRANCISCO SANTACANA. It published articles by well known Spanish farmers. The first number of the new series contains the following articles; by CLAUDIO OLIVERAS MASSO, director of the Enological Station of Reus: The aeration of must; J. MIQUEL Y CUSCO cooperation in production and mar-

keting and the value of floating capital in agriculture; JULIO TARIN, the farming outlook The review gives the legislative and administrative measures taken in Spain in regard to agriculture, and cites the Royal Decree of 1 September 1924, relative to wines and alcohol. Publishing offices of the Review: Pelayo 12 1º, 1ª Barcelona, Spain.

779. **The Missouri Year Book of Agriculture for 1924.** — The Year Book of Agriculture for 1924, issued by the Missouri State Board of Agriculture, Jefferson City, forms the November number of the *Monthly Bulletin*, Vol. XXII, No. 11, 1924. The volume consists of 487 pages of official data and facts relative to the agriculture and country life of Missouri. A good index is provided.

780. **The new Journal of The Agricultural Education Association of Great Britain,** *Agricultural Progress*, contains, in the second volume, as in the first (1924), information valuable both to research workers and farmers. The *Weekly Westminster* describes it as " a distinct advance on any agricultural publication which has previously been issued ".

781. **Yearbook of the Italian Agricultural Press.** — This publication, is issued by the " Ufficio d'incoraggiamento per esperienze di concimazione " (Bureau for the encouragement of fertiliser experiments) in Milan. It contains statistical data collected from various periodicals, regarding agriculture. It states that in Italy 229 agricultural reviews are issued and distributed as follows: Abruzzi and Molise 4; Basilicata 2; Calabria 2; Campagnia 9; Emilia 20; Lazio 25; Liguria 8; Lombardy 41; Marche 16; Piedmont 31; Puglia 4; Sardinia 2; Sicily 18; Tuscany 9; Umbria 5; Venezia Giulia 1; Venezia Tridentina 1; Veneto 17.

These periodicals may be classified in the following categories: General agriculture 146; colonial agriculture 1; agriculture, industry and commerce 9; agriculture 2, beet-culture 1, agricultural chemistry 5, cooperation 1; olive growing and oil-extraction 2; horticulture 6; floriculture 4; plant pathology 3; medicinal and aromatic plants 1; professional review 1; rice planting 1; forestry 4; sericulture and mulberry growing 4; statistics, legislation and economy 12; tobacco planting 2; vine growing 12; stockbreeding 10.

The Yearbook gives the complete list of periodicals, arranged according to provinces, with a note on the title, period of publication, name and address of editor, etc.

782. **A Pamphlet on Peruvian Guano** — The " Compañía Administradora del Guano ", the the sole agent for the sale of fertilizers in Peru, last January began the publication of a periodical treating of fertilizers and the condition of the Peruvia n soil. This Company arranged some years ago a special technical section with the object of advertising the use of guano. Later on a Laboratory for agricultural analysis was founded. This Laboratory was attached to the technical section and was at the service of farmers who wished to use guano, and made trials at cost price on small plots of land, after which the fertilizing of large areas could be carried out. The periodical has different sections: one on soil, fertilizers and plant chemistry; anther giving information on the situation and fertilizing problem in other countries; a third section given technical communications. The life history of the birds producing guano and the preparation of the product will be discussed. (*Boletín de la Compañía Administradora del Guano, Lima, Peru*).

Personal.

783. In the Proceedings of the Royal Society, London (Series B, Vol. 97, No. B 686; 1925) a biological sketch is published on the celebrated zoologist Prof. THOMAS NELSON ANNANDALE (born 1876-died 1924). Prof. ANNANDALE was a pupil of Prof. RAY LANKASTER. He was Director and Chief of the Zoological Inspectorship of India; President of the Indian Science Congress and of the Asiatic Society of Bengal. The Professor was an indefatiguable traveller, always seeking new material for comparative study of the fauna of the Asiatic lakes.

784. Prof. BERTRAND of the Pasteur Institute of Paris held a conference at Wageningen (Holland) before the National Science Association and the Chemical Society, and discussed the importance of the minimum quantity of chemical constituents and of magnesium in the biology of plants.

785. Prof. R. BIEDERMANN, founder and composer since 1880, of the well-known "Chemiker Kalender", celebrated his 80th birthday in February last.

Prof. Biedermann is connected with to the German Patent Office.

786. Dr. A. VAN BIJLERT of Nijmegen (Holland) Professor of Tropical Agriculture at the Higher School of Agriculture at Wageningen has died in his 60th year. In 1895 Dr. van Bijlert was on the staff of the State Agricultural Station (Rijkslandbouvstation). He then went to the Dutch Indies where he remained until 1903, and on his return to Holland was appointed Professor at the Wageningen School, of which he became Rector in the year 1920-21. He wrote for many reviews, especially on the subject of tropical agriculture.

787. Prof. F. CAVARA, Director of the Institute and Botanical Garden at Naples read a paper on the work of the late Prof. ANTONIO BORZÌ, the well known Director of the Botanical Garden of Palermo University and eminent phytologist and biologist. The paper was read at the Conference held in Rome on 13 January 1923 under the auspices of the Agricultural Association of Italy, and the Association has published the paper in its Proceedings (Year IV-V. No. 5, 1924). Among the numerous works of Prof. Antonio BORZÌ the most famous is the: "*Studi algologici*" at which he worked for 16 years. and which treat of chlorophyll. For this study the author was awarded the "Premio Desmazières» of the French Academy.

788. Doctor BRUNO BRUCKNER, Director of the sugar factory at Stralsund and Curator of the German Institute for the Sugar-Industry, died on February 28th 1925

789. Prof. N. H. COWDRY, botanical well known for his botanical researches on the structure of plant cells, died in January last at the age of 76.

790. Dr. ARTHUR DENDY, Professor of Zoology at King's College, London and well known for his biological works, especially investigations on sponges, died in March last at the age of 59.

791. GEORGES FROM, professor of pathology and cryptogamy at the Agricultural Institute, Paris, has been decorated Officier of the Legion of Honour.

792. In the *Proceedings of the Royal Society* of London (Series B, Vol. 97, No. B. 686; 1925) a memorial is published respecting W. A. HASWELL (1854-1925), Professor of Biology of Sydney University, who has written many works on in the field of Zoological research. He has also been one of the authors of the *Text-Book of Zoology*, which was published in close collaboration with the late Professor E. JEFFRY PARKE. This work has become a well known book of reference on Zoology.

Dr. Haswell was President of the Linnean Society of New South Wales and in 1891 was President of Section D. of the Australian Association for the Advancement of Science. He has taken an active part in the work of the Australian Museum and in 1916 was Editor of the Report of the Australian Antarctic Expedition.

793. THE "LEEUWENHOEK" MEDAL of the Academy of Science of Amsterdam has been awarded to Dr. F. d'HÉRELLE, the bacteriologist. Former medals had been awarded to ERENBERG (1875), COHN (1885), PASTEUR (1895). BEJRINCK (1905) and DAVID BRUCE (1915).

794. Dr. Ing. HANUS KARLIK, well known specialist in the Czecho-Slovakian sugar industry, celebrated at Prague his 75th birthday on 23 March, 1925.

795. PROFESSOR Dr. WALDEMAR VON KNIEREM celebrated at Riga on 11 May the fiftieth anniversary of his active career in agricultural research.

796. After a long career as a scientist and teacher, Prof. GUGLIELMO KOERNER died on 26 March at Milan, at the age of 86. He was for more than 50 years professor of organic chemistry at the Royal School of Agriculture, and at the R. Politechnical School at Milan. He was Director of the first Institution for many years. Prof. KOERNER was an active and honorary member of numerous scientific institutions such as the Accademia dei Lincei, Società Italiana delle Scienze; K. Preussische Akademie der Wissenschaften, Deutschen Chemischen Gesellschaft; Royal Society of Great-Britain; Chemical Society of London; he was Doctor *honoris causa* of the Universities of Cambridge, Oxford, and Giessen, and was awarded the "Davy" medal of the Royal Society of London and the "Lavoisier" medal of the Société Chimique de France, etc.

His studies on aromatic substances are widely known.

797. The "JOSEPH LEIDY" Medal of the Philadelphia Academy of Science has been awarded to Dr. HERBERT SPENCER JENNINGS, Professor of Zoology and Director of the Biological Laboratory at John Hopkins University.

798. The death is reported of Prof. ATTILIO LENTICCHIA, Director of the Royal National Institute of the Silk Industry at Como (Italy). Prof. LENTICCHIA is known for his numerous improvements in regard to silk production, and to the form, composition and structure of the silk thread. Latterly, he was chiefly occupied with the rearing of wild silkworms, principally of the *Antheracea Pernyi* variety and to the utilisation of their cocoons. Prof. LENTICCHIA took his degree in 1874 at the Higher School of Agriculture at Milan and was for 15 years Professor of Natural Science in the Cantonal Lyceum of Lugano.

799. Prof. FRANK R. LILLIE and his wife have given $90 000 for the new Zoological Research laboratory of the University of Chicago.

800. In the Brazilian Review *Broteria* reference is made to ADOLPH FREDERICH MOLLER who was inspector of the Botanical Garden of Coimbra University, and died in 1920 at Lisbon. He has done much work in connection with the organization of the Portuguese herbarium and wrote articles for many Reviews, especially for the *Jornal de Horticultura pratica*, the *Gazeta de Farmacia* and the *Jornal da Sociedade Pharmaceutica Lusitana*. (*Broteria*. Botanical series, vol. XXII, No. II).

801. The "RUMFORD" medal has been give by the Royal Society of Great Britain to C. V. BOYS for his discoveries in connection with gas calorimetry; the "Davy" medal has been awarded to Prof. PERKIN for his researches on the structure of natural colouring substances.

802. CARLO PRIZIBYLLA died on 27 January; since 1919 he was Director of the Institute for Potash Researchs and gave the whole of his time to the scientific problems related to the chemistry of potash, and the potash industry.

803. Prof. PAUL ROSCHER, doctor of veterinary science and Professor of anatomy and physiology of domestic animals, of the Agricultural Department of the Technical School at Prague died suddenly on April 4th. This Department is situated at Tetscher-Liebweld. He was an active member of the German Stock-Breeding Association and was editor of the Yearbook for Scientific and practical Stock-breeding (*Jahrbuch für Wissenschaftliche und praktische Tierzucht*). Among his personal works those on the "Cricetus frumentarius", on the development of the various breeds of cattle in the second year of their life (in collaboration with Prof. Muller), on the construction of a stall for experimental research on animals and various articles in different periodicals have been widely read.

804. The Dirictor of the Rothamsted Experimental Station, Harpenden, England, Sir JOHN RUSSELL, has been elected corresponding member of the "Académie des Sciences", Paris, in the Department of Rural Economy. He succeeds Prof. WINOGRADSKY who has become a foreign member of this Academy.

805. Dr. I. R. SCHRAMM has resigned the Professorship of Botany at Cornell University, on taking up his duties as Chief Editor of the *International Biological Abstracts*.

806. Prof. RICHARD ZSIGMONDY, the great investigator on colloids, was the recepient of great honours on the occasion of his 60th birthday.

A number of well-known scientists furnished articles for the Jubilee-Publication which has been published by the *Kolloid-Zeitchrift* in a handsome binding and containing a large number of original articles on physical colloid-chemistry. (See also under the heading « Journals and Reviews »).

Dott. G. A. R. BORGHESANI, *direttore responsabile*.

INTERNATIONAL REVIEW
OF THE
SCIENCE AND PRACTICE
OF
AGRICULTURE

PUBLISHED BY THE INTERNATIONAL INSTITUTE OF AGRICULTURE

New Series

Vol. III. – No. 4. – October-December 1925

ROME

PRINTING OFFICE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

1925

In quoting articles, please mention:
International Review of the Science and Practice of Agriculture,
International Institute of Agriculture.

CONTENTS

ORIGINAL ARTICLES.

Page

STOKLASA, J. The Physiological Value of Phosphoric Acid in Superphosphate and other Phosphates 921
DIAZ OSSA, B. The Chilean Nitrate Industry 942
CONSTANTINESCO, G. K. The Domestic Animals of Rumania 972
PORCHEREL, A. Heredity in the Mule 982
BRANCOVICI, E. M. State of the Cereal Crops and Trade in Rumania . 1004

INTERNATIONAL ASSOCIATIONS.

Proceedings of the International Society of Soil Science.

Papers.

TRÉNEL, M. Can the Lime-requirements of the Soil be determined from the Reaction of Soil Suspensions containing Potassium Chloride? . . 1011
NIKLAS, H. and VOGEL, F. To what Extent is the Lime Content and Reaction of a Soil related to the Manner of its Formation 1018
VILENSKY, D. The Classification of Soils on the Basis of Analogous Series in Soil Formation 1036

Abstracts and Literature.

Soil Physics: Some Factors influencing the Impermeability of Soil, *p.* 1054. — Erosion and Surface Run-off under different Soil Conditions, *p.* 1055. — Methods of Investigation of Soil Moisture, *p.* 1055.
Soil Chemistry: Chemical Properties of Soil, *p.* 1056. — Determination of Phosphoric Acid, *p.* 1057. — The Chemical Nature of a Colloidal Clay, *p.* 1057. — The Examination of Peat Materials, *p.* 1058. — Removal of Lime from the Soil, *p.* 1058. — Quartenary Alluvial Deposits, *p.* 1058. — Composition of Brick Earth, *p.* 1059. — Easily Soluble Calcium of the Soil in Relation to Acidity and Return from Liming, *p.* 1059. — Base Exchange in Soils, *p.* 1060. — Absolute Capacity, for Air and the Degree of Acidity, of Forest Soils, p. 1061. — Experiments on the Control of Wart Disease of Potatoes by Soil Treatment, with Reference to the

Use of Sulphur, *p.* 1061. — The Injurious Effect of Excessive Liming on Podsol-Soils in Connection with the Special Character of the Biological Processes taking place in such Soils, *p.* 1061. — Liming of Soils in France, *p.* 1064.

Soil Biology: The Bacterial Inoculation of Sugar Beet, *p.* 1074. — Insect and other Invertebrate Fauna of Arable Land at Rothamsted, *p.* 1075. — The Physiology of *Thiobacillus thioxidans* an Autrophic Bacterium Oxidizing Sulphur under Acid Conditions, *p.* 1075. — The Carbon and Nitrogen Nutrition of *Thiobacillus thioxidans* an Autotrophic Bacterium Oxidizing Sulphur under Acid Conditions, *p.* 1076. — Seed Inoculation of Lucerne (*Medicago sativa*) and its Relation to Mobility of Nodule Organisms in Soil, *p.* 1076. — The Importance of the Concentration of the Hydrogen-ions of the Soil in the Formations of Plant Substance, *p.* 1077.

Soil and Vegetation: The Effect of a Varying Supply of Nutrients upon the Character and Composition of the Maize Plant at Different Periods of Growth, *p.* 1078. — Comparative Value of Alfalfa and Sweet Clover on Soils, *p.* 1079.

Regional Soil Science: The Geology of Istria, *p.* 1080. — Goethe and the Sicilian Red Earth, *p.* 1081. — The Soils of Moistad Experiment Station, Hedmark, Norway, *p.* 1081. — Soils of Pays de Gex, Gravigne, Gillet and Denizet, *p.* 1082. — Beetroot Soils in Bohemia, *p.* 1083. — Soils of Overflow Meadows on the Banks of the Volxhov and Lake Ilmen, *p.* 1083. — Geology of the Sarthe, *p.* 1084. — The Agricultural Regions of North Dakota, *p.* 1085. — The Principal Results and Fundamental Problems of Soil Investigation in Georgia, *p.* 1085.

Bibliography, *p.* 1087.

General Information.

International Society of Soil Science, *p.* 1090. — Brief Statement concerning Progress made in the Organisation of the First International Congress on Soil Science, *p.* 1090. — Position of Soil Mapping in the Various Countries (« Etat de l'étude et de la cartographie du sol dans les divers pays »), *p.* 1091. — Appeal for Cooperation in the Work of the Sixth Commission on the Application of Soil Science to Scientific Agriculture, *p.* 1092.

Proceedings of the International Seed Testing Association.

Papers.

GENTNER, G. Contribution to a Monograph on the Determination of the Country of Origin of Clover and Forage Crop Seed. 1095

FRANÇOIS, L. The Place of Origin of Seeds 1134

VON PETERY, W. Investigation in Regard to Weed Seeds of Argentina, with Reference to their Origin and Distribution in the Producing Districts of Argentina. 1163

Abstracts and Literature.

Uniformity in Seed Testing Reports, *p.* 1173. — The Determination of Moisture in Seeds, *p.* 1174. — Reports on Purity of Seeds, *p.* 1174. — Report of the Dodder Committeee, *p.* 1175. — The Work of the Official Seed Testing Station for England and Wales, *p.* 1175. — The Vitality of Buried Seeds, *p.* 1176. — Admixture of Annual Argentine Rye Grass Seed in English and Italian Rye Grass Seed, *p.* 1176.

General Information.

Members of the International Seed Testing Association, and International Seed Testing Stations, *p.* 1177.

SPECIAL ACTIVITIES OF THE BUREAU OF AGRICULTURAL SCIENCE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE.

Enquiry on Locust Control.

Locusts in Iraq, *p.* 1182.
International Organisation for Locust Control, *p.* 1189.

AGRICULTURAL INTELLIGENCE.

Agronomy.

Soil Science. — See R. Part II, *Proceedings of the International Society of Soil Science*, Abstracts.

Fertilisers and Manures. — 807. Availability of Nitrogen in Organic Manures. — 808. Preparation of Phosphoric Acid; Replacement of Sand by Potash Silicates in the Volatilization Process. — 809. Determination of Phosphoric Acid in Fertilisers. — 810. Phosphatic Manuring of Pastures in Western Australia. — 811. Residual Effect of Acid Phosphate and Rock Phosphate. — 812. American Potash. — 813. The Utilization of Leucite as a Source of Alumina, Potash and Silica. — 814. Potash from Cement Dust. — 815. Increasing Ammonia Production with Improved Catalysts. — 816. A Colorimetric Method for determining Nitrate Nitrogen. — 817. Pot and Field Experiments with Common Salt. — 818. The Effect of Manganese on the Growth and Yield of Rice. — 819. Manganese Chlorosis of Pine Apples, its Cause and Control. — 820. Recent Progress in Insecticides and Fungicides. — 821. Some Chemical Problems of the Insecticide Industry. — 822. The Determination of Free Calcium Hydroxide in Commercial Calcium Arsenate.

Agricultural Botany, Chemistry and Physiology of Plants. — 823. Agricultural Ecology. — 824. The Origin and Geographical Affinities of the Flora of

California. — 825. Relation between Structure and Chemical Nature of the Beetroot. — 826. The Nitrogenous Metabolism of the Higher Plants. — 827. Hydrocyanic Acid as a Toxic Agent to Plant Growth. — 828. The Feeding Powers of Plants in Different Soil Horizons. — 829. Athmospheric Electric Currents, Normal and Abnormal, and their Reaction on the Growth of Plants.

Crops in Temperate and Tropical Countries.

(Including Forestry).

Cereals, Roots and Forage Crops. — 830. New Varieties of Wheat in Queensland. — 831. Varietal Experiments with Red Winter Wheats in Dry Areas of the Western United States. — 832. The Effect of Spacing on the Yield of Wheat. — 833. Inheritance of Resistance to *Puccinia Graminis* in Crosses between Varieties of Durum Wheat. — 834. A New Variety of Oats — 835. The Origin of Maize. — 836. The Relation between Seed-Ear Characters and Productiveness in Maize. — 837. Improvement of Paddy Varieties. — 838. Variety Trials of Potatoes in England. — 839. Edible Canna in Hawaii. — 840. The Time of harvesting Soybeans from Hay and Seed. — 841. The Belhambra (*Phytolacca dioica*) as a Fodder Plant.

Tropical and Subtropical Industrial Plants. — 842. Plant Textile Fibres produced in the British Empire. — 843. Inheritance and Inter-relationship of the Principal Character of the Flax Plant. — 844. Cotton Grading. —845. Improvement of Queensland Cotton Seed. — 846. The Effect of Water on the Cotton Plant. — 847. Cotton Growing in Relation to Climate in Egypt and the Sudan. — 848. Ratoon Cotton in Egypt. — 849. Cotton Growing in Madras. — 850. The " Babassù ". — 851. Variation in Coconuts with reference to Fruit Production. — 852. Resins and Oleo-Resins of Indo-China. — 853. The Beet Crop in Czechoslovakia in 1924. — 854. Coffee Planting in Tanganyika Territory. — 855. Tea in Ceylon. — 856. The Effect of Distancing on Tobacco Leaf.

Arboriculture and Forestry. — 857 Fruit Growing in British Columbia. — 858. Investigation on Apples with Special Reference to Cider Apples. — 859. American Stocks in Viticulture in South Africa. — 860. Eucalyptus Species for Supply of Electric Power Transmission Poles.

Live Stock and Stock Breeding.

General. — 861. The Disinfection of Stables. — 862. Paralysis of Chickens due to Coccidiosis. — 863. Variations and Constant Relations in the Quantity of Milk and the Fat Content. — 864. The Effect of Season on Milk and Fat Production of Jersey Cows. — 865. The Food Value of Algae. — 866. The Effect of Cane Molasses on the Digestibility of a Complete Ration fed to Dairy Cows. — 867. Yeast as Supplementary Feed for Dairy Cows. — 868. The Volume of the Ration. — 869. Experiments in Stock Feeding at

the Stock Breeding Centre of Clos Ry (Nièvre, France). — 870. The Breed. — 871. Are Milk Record Association Results Accurate? — 872. Calculating the Average Production of a Dairy Herd.

Special. — 873. Feeding Experiments with Dairy Cows. — 874. Milk Production and Draught-Efficiency — 875. Improvements in Sheep Breeding in Morocco.

Poultry. — 876. Poultry Breeding. — 877. Selection of Poultry at the Farm.

Pisciculture. — 878. Pond Fertilising.

Farm Engineering.

Hydraulics and Methods of Cultivation. — 879. Power for the Farms from Small Streams. — 880. The Spacing of Crops.

CURRENT NOTICES.

Legislative and Administrative Measures. — 881. Chile: Regulations for the Sale of Nitrate of Soda. — 882. Chile: Regulations for Advances of Seeds. — 883. Esthonia: Importation of Live Cattle and Animal Products. — 884. Belgium and Luxemburg: Excusing of Certificate of Origin in the Case of the Superphosphates of the Economic Customs Union of Belgium and Luxemburg imported into France. — 885. France: Supervision of the production of Silkworm Eggs.—886. Ivory Coast: Control of Cotton, Rubber, Rice, Kola Nuts and Bird Lime.—887. French West Africa: Breeding of Merino Sheep in the Haute Volta. — 888. Latvia: Fund for Seeds. — 889. Luxemburg: Importation of Oats for Sowing. — 890. Rumania: Testing of Seeds of Forage Plants. — 891. Rumania: The New Wheat Flour and Bread Regulations.—892. Rumania: Institution of Agricultural Chambers.

Experiment Stations and Agricultural Instruction. — 893. Germany: Experimental Stations of Lauchstädt and Gross-Lubars. — 894. Germany: Experimental Forestry Institutes. — 895. Germany: Courses in Rural Mechanics in Bavaria. — 896. Austria: The Fiftieth Anniversary of the Experimental Forestry Institute of Mariabrunn. — 897. Belgium: The Mechanical Laboratory of the Non-State University of Solbosch, Brussels. — 898. Brazil: Agricultural Experiment and Instruction during 1924. — 899. Bulgaria: A New Stock Breeding Station. — 900. China: The Ling Nan Agricultural College, Canton. — 901. China: The College of Agriculture and Forestry, University of Nanking. — 902. China: Agricultural Education at Peking University (Yenching). — 903. United States: Annual Report of the Agricultural Experiment Stations, University of Louisiana, 1923. — 904. United States: Tropical Plant Research Foundation. — 905. United States: Study of Ornamental Plants. — 906. United States: Research Fellowship in the Chemistry of Perfumes and Essential Oils. — 907. United States: Conference on Gardening. — 908. Unit-

ed States: University of Michigan Biological Station. — 909. Transfer of the Collection of Type Cultures of the American Museum of Natural History to the McCormick Memorial Institute of Chicago. — 910. United States: Livestock Experiment Station, Milex City, Montana. — 911. Research on the Applications of Electricity to Agriculture. — 912. France: Experimental Work in Olive Cultivation, etc. — 913. France: Valuable Collections belonging to the "Laboratoire d'Agronomie coloniale" (Paris) destroyed by Fire. — 914. France: The Centenary of the Nancy National School of Waters and Forests. — 915. France: Instruction in Poultry Keeping. — 916. France: Experiments in Sericulture. — 917. France: Diploma of Expert Producer of Silkworm Seeds. — 918. France: Schools of Agriculture. — 919. France: Agricultural Subjects for Prize Competition. — 920. France: Agricultural Educational Journey in Alsace. — 921. Tunis: Agricultural Education. — 922. French West Africa: Ivory Coast. La Mé Experimental Station. — 923. Dahomey: The Pobé Experimental Station.—924. Great Britain: A Section of Timber Technology at the Imperial Forestry Institute, Oxford. — 925. Scottish Experimental Stock Farm. — 926. Great Britain: Training of Agricultural Organizers and Lecturers. — 927. Great Britain: Settlers' College. — 928. Great Britain: Scientific Research Workers. — 929. British Guiana: The Kartabo Laboratory of Tropical Biology. — 930. India: The Technological Research Laboratory of the India Central Cotton Committees. — 931. Ceylon: New Chemical Laboratory at Peradeniya. — 932. The Imperial College of Tropical Agriculture, Trinidad. — 933. Palestine: The Hebrew University of Jerusalem. — 934. Hungary: Higher Forestry Instruction. — 935. Italy: The Bari Agricultural Experimental Station. — 936. Italy: Development of the Agricultural Cinematograph. — 937. Paraguay: School of Agriculture at Asunción. — 938. Czecho-Slovakia: Jubilee of the School of Agriculture of Tetschen Liebwerd. — 939. Czecho-Slovakia: Agricultural Museums. — 940. Czecho-Slovakia: Course of Instruction for Milk Testers, at Znaim.

Agricultural and Scientific Associations and Institutions. — 941. The Singapore Office of Epidemiology. — 942. The Belgian Peasants' Union. — 943. Brazil: The Government Seeds Service and the Cotton Service. — 944. Brazil: A Permanent Government Agricultural Information Service. — 945. France: "Colonie-Sciences" Association. — 946. Great Britain: Apple Packing Station. — 947. Canada: The Dominion Water Power and Reclamation Service. — 948. Italy: The "Parco Nazionale d'Abruzzo". — 949. Czecho-Slovakia: Horse-Breeding in Czecho-Slovakia.

Congresses and Conferences. — 950. France: International Dairy Conference. Paris, May, 1925. — 951. Canada: World's Poultry Congress 1927. — 952. Belgium: Second International Conference for the Unification of the Formula for Heroic Remedies. Brussels, September 21, 1925. — 953. I. International Congress of the Technical Press, Paris, September, 1925. — 954. Rumania: International Congress of Pure and Applied Chemistry. Bucharest, last week of June, 1925. — 955. Poland: First International Conference of Sugarbeet Growers. Warsaw, 20 June, 1925. — 950. France:

International Silk Congress, Paris, 12-13 June, 1925. — 957. Proceedings of the Second World Poultry Congress. — 958. Germany : General Assembly of the German Chemical Societies of Food Industries. — 959. Belgium : Maritime and Colonial Congress. Ostend, 24-28 August, 1925. — 960 Brazil : Oil Congress. San Paolo, Brazil. — 961. Canada : Fox Congress, Montreal, 26-28 June, 1925. — 962. French National Week for the Export of Agricultural Products. — 963. France : Ninth National Congress of Fishery and Sea Industries. Bordeaux and Arcachon, September, 1925. — 964. France : Congress of Table Grapes, Agen, August, 1925. — 965. France : Fifth Annual Reunion of the " Comptoir Français de l'Azote ". Paris, June, 1925. — 966. France : Seventh French Agricultural Congress. Rouen, 13-15 May, 1925. — 967. France : Wood Charcoal Congress. Blois, 26 April, 1925. — 968. Great Britain : The Imperial Entomological Conference, London, 9 to 18 June, 1925. — 969. Ninth Congress of Italian Olive-Growers. Bari, 19-21 October, 1925. — 970. Italy : Fifth National Forestry Congress and National Forestry Exhibition, Campobasso, 10-12 September, 1925. — 971. Italy : National Land Improvement Congress, Naples, 3 to 5 September, 972. Italy : " Convegno del pesco ", Canale d'Alba, Cuneo, 16-19 July, 1925. — 973. Italy : Industrial Week of Experts and Persons engaged in the Chemical and Allied Industries. Turin, June, 1925. — 974. Italy : Congress on Vines and Wine. Trento, 24 June, 1925. — 975. Italy : National Congress of the Sugar and Alcohol Industries. Ferrara, 33 May, 1925. 976. Italy : Third National Congress of Tobacco Growers, Bologna, 25 May, 1925.

Exhibitions, Fairs, Competitions. — 977. Italy : International Competition of Viticultural Machinery, Barletta. — 978. Argentina : International Exhibition of Hygiene, Art, and Industry. Rosario, 5 December 1925, 5 March 1926. — 979. Cuba : International Sample Fair, Havana, December, 1925. — 980: France : International Exhibition of the " Société des Aviculteurs du Nord ". Lille, 12-14 December, 1925. — 981. Great Britain : British Empire Exhibition, Wembley Park. London, April to October, 1925. — 982. Belgium : Eighth International Poultry Fair, Brussels, 5 to 7 September, 1925. — 983 Bolivia : International Manufactures Fair. La Paz, August, 1925. — 984. Fifth International Exhibition and Fair, Riga, 19 July-31 August, 1925. — 985. International Sample Fair. Bandoeng, 20 June-4 July, 1925. — 986. France : International and Colonial Sample Fair. Bordeaux, 15-30 June, 1925. — 987. Second International Book Fair. Florence, 30 June, 1925. — 988. Italy : First International Exhibition of the Gas and Water Industries. Padua, June, 1925. — 959. Finland : Sixth International Finnish Fair. Helsingfors. — 990. Germany : XXXIst Travelling Exibition of the German Agricultural Society. Stuttgart, Wurtemberg, 18 to 25 June, 1925. — 991. Austria : Fundamental Criteria for the Judging and Awarding of Prizes to Cattle in Lower Austria. — 992. Austria : The Part taken by Agriculture in the Vienna Fair and the Principles regulating it in Lower Austria. — 993. Brazil : Agricultural Livestock Exhibition, 1925. — 994. Brazil : 1st Exhibition of Milk and its Derivatives. St. Paul, 12-20 October 1925. — 995. Bulgaria : Stock

Breeding Exhibition. Rasgrad, Autumn, 1925. — 996. Pomological Exhibition, Santiago Chile, March 1925. — 997. France: VIth Competition for the Finest Ear of Corn in France. Bordeaux, October, 1925. — 998. France: Exhibition of Agricultural Tractors. Buc, Versailles, 20 September to 4 October, 1925. — 999. France: The Lower Rhine Horticultural Exhibition. Strassburg, June, 1925. — 1000. France: Gastronomic Fair. Havre, 11-20 April, 1925. — 1001. France: Competition for the Selection of the Black Spotted Breton Breed for the Departments of Finistère and Morbihan (France), 1925. — 1002. Great Britain: Textile Machinery Exhibition. Manchester, 2-17 October, 1925. — 1003. Great Britain: Annual Sanitary Exhibition. Edinburgh, 20-25 July, 1925. — 1004. Great Britain: National Commerce Exhibition. Liverpool, 6-25 July, 1925. — 1005. Canada: Canadian National Exhibition. Toronto, 25 August to 12 September, 1925. — 1006. Italy: National Land Improvements Exhibition. Naples, August, 1925. — 1007. Persia: Agricultural Exhibition. Teheran, August, 1925. — 1008. Czecho-Slovakia: Agricultural Exhibition. Prague, 15-21 May, 1925. — 1009. Turkish Floating Exhibition, sailed July, 1925.

Development of Agriculture in the Different Countries. — 1010. Austria: Reafforestation in Lower Austria. — 1011. Development of Agriculture in Brazil in 1924. — 1012. Brazil: Coffee Plantations in the State of San Paulo. — 1013. Brazil: The Coffee Plantations of Parana. — 1014. Hong-Kong: Camphor Plantation. — 1015. India: Progress of Cultivation of Improved Varieties of Crops. — 1016. Nyasaland: Note on Cotton Growing. — 1017. The Oil-Palm Industry and West Africa. — 1018. Rumania: The Development of Agriculture in Rumania as a Result of Agricultural Reforms. — 1019. Czecho-Slovakia: The Improvement of Pasture Lands in Slovakia.

Miscellaneous. — 1020. Brazil: The " Babassu " and Derivatives Industry. — 1021. Brazil: Dictionary of the Valuable Plants of Brazil. — 1022. Chile: Nitrate Costs. — 1023. International Scientific Tables. — 1024. American Bibliography of the Natural Sciences. — 1025. France: Promotion of Rural Engineering. — 1026. France: The Origin of Maize and the Production of New Varieties. — 1027. France: Practical Classification of the Principal Varieties of Wheat cultivated in France and in French North Africa. — 1028. France: Electrification of the Country Districts. — 1029. Tunis: Pig-breeding in Tunisia. — 1030. Great Britain: Yeoman II Seed Wheat. — 1031. Sugar Beet from Field to Factory. — 1032. Great-Britain: Improved Incubators. — 1033. Great-Britain: The Manufacture of Synthethic Ammonia at Billingham. — 1034. A Commercial Atlas. — 1035. Italy: The Nitrogen Problem. — 1036. Holland: Potash. — 1037. Pomology and Pomologists.

Journals and Reviews. — 1038. Austria: An Agricultural Market Gazette. — 1039. Austria: The " Landwirt ". — 1040. Austria: The Vienna Centralblatt für das gesamte Forstwesen. — 1041. A New Brasilian Agricul-

International Silk Congress, Paris, 12-13 June, 1925. — 957. Proceedings of the Second World Poultry Congress. — 958. Germany : General Assembly of the German Chemical Societies of Food Industries. — 959. Belgium : Maritime and Colonial Congress. Ostend, 24-28 August, 1925. — 960 Brazil : Oil Congress. San Paolo, Brazil. — 961. Canada : Fox Congress, Montreal, 26-28 June, 1925. — 962. French National Week for the Export of Agricultural Products. — 963. France : Ninth National Congress of Fishery and Sea Industries. Bordeaux and Arcachon, September, 1925. — 964. France : Congress of Table Grapes, Agen, August, 1925. — 965. France : Fifth Annual Reunion of the "Comptoir Français de l'Azote". Paris, June, 1925. — 966. France : Seventh French Agricultural Congress. Rouen, 13-15 May, 1925. — 967. France : Wood Charcoal Congress. Blois, 26 April, 1925. — 968. Great Britain : The Imperial Entomological Conference, London, 9 to 18 June, 1925. — 969. Ninth Congress of Italian Olive-Growers. Bari, 19-21 October, 1925. — 970. Italy : Fifth National Forestry Congress and National Forestry Exhibition, Campobasso, 10-12 September, 1925. — 971. Italy : National Land Improvement Congress, Naples, 3 to 5 September, 972. Italy : "Convegno del pesco", Canale d'Alba, Cuneo, 16-19 July, 1925- — 973. Italy : Industrial Week of Experts and Persons engaged in the Chemical and Allied Industries. Turin, June, 1925. — 974. Italy : Congress on Vines and Wine. Trento, 24 June, 1925. — 975. Italy : National Congress of the Sugar and Alcohol Industries. Ferrara, 33 May, 1925. 976. Italy : Third National Congress of Tobacco Growers, Bologna, 25 May, 1925.

Exhibitions, Fairs, Competitions. — 977. Italy : International Competition of Viticultural Machinery, Barletta. — 978. Argentina : International Exhibition of Hygiene, Art, and Industry. Rosario, 5 December 1925, 5 March 1926. — 979. Cuba : International Sample Fair, Havana, December, 1925. — 980. France : International Exhibition of the "Société des Aviculteurs du Nord". Lille, 12-14 December, 1925. — 981. Great Britaln : British Empire Exhibition, Wembley Park. London, April to October, 1925. — 982. Belgium : Eighth International Poultry Fair, Brussels, 5 to 7 September, 1925. — 983 Bolivia : International Manufactures Fair. La Paz, August, 1925. — 984. Fifth International Exhibition and Fair, Riga, 19 July-31 August, 1925. — 985. International Sample Fair. Bandoeng, 20 June-4 July, 1925. — 986. France : International and Colonial Sample Fair. Bordeaux, 15-30 June, 1925. — 987. Second International Book Fair. Florence, 30 June, 1925. — 988. Italy : First International Exhibition of the Gas and Water Industries. Padua, June, 1925. — 959. Finland : Sixth International Finnish Fair. Helsingfors. — 990. Germany : XXXIst Travelling Exibition of the German Agricultural Society. Stuttgart, Wurtemberg, 18 to 25 June, 1925. — 991. Austria : Fundamental Criteria for the Judging and Awarding of Prizes to Cattle in Lower Austria. — 992. Austria : The Part taken by Agriculture in the Vienna Fair and the Principles regulating it in Lower Austria. — 993. Brazil : Agricultural Livestock Exhibition, 1925. — 994. Brazil : 1st Exhibition of Milk and its Derivatives. St. Paul, 12-20 October 1925. — 995. Bulgaria : Stock

Breeding Exhibition. Rasgrad, Autumn, 1925. — 996. Pomological Exhibition, Santiago Chile, March 1925. — 997. France : VIth Competition for the Finest Ear of Corn in France. Bordeaux, October, 1925. — 998. France : Exhibition of Agricultural Tractors. Buc, Versailles, 20 September to 4 October, 1925. — 999. France : The Lower Rhine Horticultural Exhibition. Strassburg, June, 1925. — 1000. France : Gastronomic Fair. Havre, 11-20 April, 1925. — 1001. France: Competition for the Selection of the Black Spotted Breton Breed for the Departments of Finistère and Morbihan (France), 1925. — 1002. Great Britain : Textile Machinery Exhibition. Manchester, 2-17 October, 1925. — 1003. Great Britain : Annual Sanitary Exhibition. Edinburgh, 20-25 July, 1925. — 1004. Great Britain : National Commerce Exhibition. Liverpool, 6-25 July, 1925. — 1005. Canada : Canadian National Exhibition. Toronto, 25 August to 12 September, 1925. — 1006. Italy : National Land Improvements Exhibition. Naples, August, 1925. — 1007. Persia : Agricultural Exhibition. Teheran, August, 1925. — 1008. Czecho-Slovakia : Agricultural Exhibition. Prague, 15-21 May, 1925. — 1009. Turkish Floating Exhibition, sailed July, 1925.

Development of Agriculture in the Different Countries. — 1010. Austria : Reafforestation in Lower Austria. — 1011. Development of Agriculture in Brazil in 1924. — 1012. Brazil : Coffee Plantations in the State of San Paulo. — 1013. Brazil : The Coffee Plantations of Parana. — 1014. Hong-Kong : Camphor Plantation. — 1015. India : Progress of Cultivation of Improved Varieties of Crops. — 1016. Nyasaland : Note on Cotton Growing. — 1017. The Oil-Palm Industry and West Africa. — 1018. Rumania : The Development of Agriculture in Rumania as a Result of Agricultural Reforms. — 1019. Czecho-Slovakia : The Improvement of Pasture Lands in Slovakia.

Miscellaneous. — 1020. Brazil : The " Babassu " and Derivatives Industry. — 1021. Brazil : Dictionary of the Valuable Plants of Brazil. — 1022. Chile : Nitrate Costs. — 1023. International Scientific Tables. — 1024. American Bibliography of the Natural Sciences. — 1025. France : Promotion of Rural Engineering. — 1026. France : The Origin of Maize and the Production of New Varieties. — 1027. France : Practical Classification of the Principal Varieties of Wheat cultivated in France and in French North Africa. — 1028. France : Electrification of the Country Districts. — 1029. Tunis : Pig-breeding in Tunisia. — 1030. Great Britain : Yeoman II Seed Wheat. — 1031. Sugar Beet from Field to Factory. — 1032. Great-Britain : Improved Incubators. — 1033. Great-Britain : The Manufacture of Synthethic Ammonia at Billingham. — 1034. A Commercial Atlas. — 1035. Italy : The Nitrogen Problem. — 1036. Holland : Potash. — 1037. Pomology and Pomologists.

Journals and Reviews. — 1038. Austria : An Agricultural Market Gazette. — 1039. Austria : The " Landwirt ". — 1040. Austria : The Vienna Centralblatt für das gesamte Forstwesen. — 1041. A New Brasilian Agricul-

tural Review. — 1042. A New French Review on Present Day Problems in Agriculture. — 1043. The Paris Scientific Review. — 1044. English Avicultural Manual. — 1045. Holland: II Nederlandsch Weekblad voor Zuivelbereiding en Handel. — 1046. Annual of the Swedish Pomological Society.

Personal. — 1047. ARISTIDES AGRAMONTE. — 1048. RUTILLUS ALDEN. — 1049. ALBERT C. BURRAGE. — 1050. THOMAS L. CASEY. — 1051. L. E. CLEVELAND. — 1052. MAX CREMER. — 1051. Madame CURIE. — 1054. MARTIN H. FISCHER. — 1055. KURT GOTTLOB. — 1056. BATTISTA GRASSI. — 1057. ALBIN HALLER. — 1058. BALTZER. — 1059. P. KULISCH. — 1060. E. MAROGER. — 1061. MARQUARD. — 1062. U. SZALATNAY. — 1063. G. VON SEDLMAYR. — 1064. T. J. FAYDIT. — 1065. KWOK WAH SHAU.

NOTE. — The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in this *Review*.

The Editor's notes are marked (*Ed.*); the letter *R.* indicates the references to the foregoing issues (Monthly and Quarterly) of the International Review.

ORIGINAL ARTICLES

THE PHYSIOLOGICAL VALUE OF PHOSPHORIC ACID IN SUPERPHOSPHATE AND OTHER PHOSPHATES.

The question of plant food equivalents at the present day mainly resolves itself into the problems of nitrogen and phosphorus supplies for our cultivated plants. The phosphorus problem in particular has assumed such prominence that a great number of investigators in the bio-chemistry of plants and soil have set themselves to ascertain whether the water soluble phosphoric acid of the superphosphates can be replaced by other phosphates. Attention has already been drawn to the cost of breaking down the raw phosphates by means of sulphuric acid, which amounts to hundreds of thousands of dollars every year. This exceptionally large expenditure, together with the great competition of other fertilisers, in particular basic slags, which do not require acid treatment, is causing anxiety in technical circles even in respect to a comparatively near future.

According to calculations made in 1913, about 6 600 000 tons of mineral phosphate were manufactured into 11 000 000 tons of superphosphate by means of 6 690 000 tons of sulphuric acid (*).

Of late years an effort has been made to introduce the use of phosphates, the manufacture and breaking down of which is effected either by chemical, or by biological means.

To the first group, in which the phosphates are produced by chemical means, belong the following:

I. 1. Pure calcium di-phosphate with 42.27 % of total phosphoric acid, completely soluble in PETERMANN'S solution.

(*) See INTERNATIONAL INSTITUTE OF AGRICULTURE, BUREAU OF AGRICULTURAL SCIENCE, *Production et consommation des engrais chimiques dans le monde.* 3rd ed., with maps and diagrams. Rome, 1924.

2. Pure calcium tri-phosphate containing 45.70 % total phosphoric acid, of which 17.27 % is citrate soluble.

3. Ground basic slag with 18.21 % phosphoric acid citrate soluble and 18.88 % total phosphoric acid.

4. Rhenania phosphate from the "Fors" establishment with 25.91 % total phosphoric acid, of which 25 % is soluble in citric acid, and 24.13 % citrate soluble.

5. Belgian sinter phosphate with 17.69 % total phosphatic acid, of which 14.56 % is soluble in citric acid.

6. "Reform" phosphate produced according to the process of O. REITMAIR, Vienna, and manufactured by the Reform-Fertiliser Company, Schwarz & C., of Vienna. The product contains 21-22 % total phosphoric acid, of which 2-3 % is soluble in water, 3-4 % in citrate and 9-10 % in citric acid.

7. Neutral phosphate, produced by the *Montan- und Industriewerke* formerly JOH. DAV. STARCK, Kasniov near Pilzen according to the process of F. HELLER, Prague. The product contains 23-27 per cent. total phosphoric acid, of which 5-6 % are soluble in water, 10-12 % soluble in citrate and 16-18 % soluble in citric acid. Under the influence of carbonic acid and water, after 62 days 82-83 % of the total phosphoric acid contained in the neutral phosphate are dissolved.

8. Finely ground raw phosphate of DE HAËN, Seelze, containing 33.80 % total phosphoric acid.

9. Colloid phosphate of the same firm with 24.65 % total phosphoric acid.

10. Humus phosphate is produced by biological means, following the method of JULIUS STOKLASA. The humus phosphate contains 12-13 % phosphoric acid soluble in the soil, 20-25 % organic matter and in 1 gm. 600-800 millions of active bacteria.

***

As early as the nineties of the last century I made a number of detailed chemical and physiological studies of the different forms of phosphoric acid, soluble and insoluble in water, in order to find a basis for judging the physiological values which the various forms of phosphoric acid have for the building-up of the new plant living substance. I w a s a l s o t h e f i r s t t o i s o l a t e a n d a n a l y s e a l l w a t e r s o l u b l e f o r m s o f p h o s p h o r-

ic acid in super-phosphates and to carry out comparative experiments on their reactions in the different soils. The physical and chemical character of the ortho-phosphoric acid of the monophosphates as well as that of the di- tri- and tetraphosphates is of immense importance to an understanding of the mechanics of numerous reactions in the study of the compounds of phosphoric acid with the constituents of the soil. In my opinion this method is much more in keeping with reality than a whole series of experiments with the superphosphates, in which the phosphoric acid appears in so many various forms and in which the composition of the superphosphates has usually not been taken into account by those who made the experiments.

The water soluble part of phosphoric acid in superphosphate consists of:

I. Free-phosphoric acid.
II. Calcium monophosphate.
III. Magnesium monophosphate.
IV. Iron monophosphate.
V. Aluminium monophosphate.

The superphosphate manufactured from the Florida phosphate at present in so much demand, when broken down with sulphuric acid of 50° B. contains water soluble phosphoric acid in the following forms:

P_2O_5 soluble in water . . .	17.69 %	and that:
Monophosphate of calcium .	5.60 %	
Free-phosphoric acid	10.62 %	
Monophosphate of magnesia	0.54 %	
Monophosphate of iron . . .	0.51 %	
Monophosphate of aluminium	0.42 %	

Bone-dust-superphosphate, with the glue removed, manufactured from bone-dust (broken down by sulphuric acid of 60°B.) contains water-soluble phosphoric acid in the following forms:

P_2O_5 soluble in water . . .	18.60 %	and that:
Monocalciumphosphate . . .	16.36 %	
Free-phosphoric acid . . .	2.24 %	

Usually all superphosphates manufactured from mineral phosphates by means of sulphuric acid of 50° B contain phosphoric acid

in large quantities in the form of ortho-phosphoric acid; glue-free bone-dust on the contrary, broken down by 60° B. acid mostly contains phosphoric acid in the form of monocalcium-phosphate. The bisuperphosphates mostly contain water-soluble phosphoric acid in the form of monocalcium phosphate.

The subsequent modifications of water soluble phosphoric acid in the soil under the influence of calcium carbonate and calcium bicarbonate and that of iron and aluminium compounds, present problems of considerable interest.

Phosphoric acid in the form of monophosphates in the soil shows quite a different chemical reaction from that of ortho-phosphoric acid. Supposing we employ 5 quintals of superphosphate with 20 % soluble phosphoric acid per ha. and that we reduce the latter to monocalcium phosphate, to every hectare of arable soil there is 178 kg. monocalcium phosphate. If we assume further that arable soil has a specific gravity of 1.5 and a content of 0.4 % calcium carbonate, a percentage often to be met with in our soils, then the monocalcium phosphate in 20 cm. of arable soil is in contact with 12 000 kg. calcium carbonate. Thus to one part of the mono-phosphates there always correspond 66 parts of calcium carbonate.

Under these conditions besides dicalcium phosphate, tricalcium phosphate will always form, as was the case with our experiments. From these examples it may be inferred that the phosphate-ions cannot long remain in a soluble condition in the soil. On the basis of my experiments I was able to state that this transposition of the total mass does not occur suddenly, but needs a certain time. As the water soluble forms of the phosphoric acid penetrate into the deeper layers of the arable, meadow, forest and garden soil, the water soluble phosphoric acid is of course continually transformed into insoluble forms, a fact which I have also proved by special experiments.

According to our observations carried out for many years on soils free from iron and aluminium compounds, the water soluble phosphoric acid, if present in the form of monocalcium-phosphate, is transformed in the soil into water insoluble forms and actually into tricalcium phosphate within 32-38 *days. But if the phosphoric acid occurs in the form of orthophosphoric acid, the phosphoric acid in the soil is only transformed into diphosphates and triphosphates after* 36-48 *days.*

The circulation of the calcium carbonate dissolved in water chiefly occurs in the soil in the form of $CaH_2(CO_3)_2$. As is known from numerous analysis, the soil atmosphere always contains carbon-

dioxide and sometimes in considerable quantities (0.05-1 %). One litre of distilled water saturated with carbon di-oxide dissolves 0.244 to 0.27 gm. of $CaCO_3$ (1). The more calcium carbonate there is contained in the soil, the quicker the forms of the phosphoric acid soluble in water are transformed into di- and triphosphates. From the preceding examples we see how easily the carbonic acid soluble in water may be transformed into an insoluble form, when it comes into contact with calcium carbonate in various soils and at different depths: they also afford proof that it is of some importance whether the superphosphate contains water soluble phosphoric acid in the form of monophosphates, or ortho-phosphoric acid. The di- and tricalciumphosphates and even magnesium phosphates arising from the water soluble forms of phosphoric acid are very easily re-transformed into monophosphates by the biochemical processes in the soil and re-absorbed by the root system of the cultivated plants.

Hence the remarkably favourable effect of superphosphate in building up the living substance of plants becomes fully intelligible. Besides calcium carbonate and magnesium carbonate, calcium-, magnesium aluminium-, ferro- and ferri-silicates also bring about in the soil the transformation of water soluble phosphoric acid into the insoluble form.

We will now consider the influence of the sulphates occurring in the soil, upon the phosphoric anhydride of the soil solution.

According to my experiments there are no compounds insoluble in water formed from water soluble phosphoric acid under the influence of the calcium, magnesium, and aluminium sulphate. I have called attention to the fact that aluminium phosphate with water soluble phosphoric acid does not give insoluble compounds. Ferro- and ferrisulphates however behave in quite a different way. When these come into contact with the water soluble phosphoric acid in the soil, there are always formed ferro- and ferriphosphates, insoluble in water.

From this it may be seen that in the presence of ferro- and ferrisulphate, ortho-phosphoric acid and monocalcium-phosphate, transform themselves into insoluble ferriphosphates, that is to say that soluble phosphoric acid is transformed into the insoluble form.

(1) According to my investigations, per 1 hectare of soil and in a 30 cm. layer at a temperature of 13-17 ° C. the following quantities of carbon dioxide are formed in 200 days:

Barren soil.	120 q.
Soil of average quality	240 q.
Very fertile soil	480 q.

The ferro- and ferrisulphates in the soil must be considered as injurious salts, because they cause an immediate transformation of the soluble compounds of the phosphoric acid into insoluble forms.

We have observed interesting phenomena which show that the free ortho-phosphoric acid is transformed with the ferro- and ferri-compounds into insoluble ferro- and ferri-phosphates, which, as having a very small excess of ortho-phosphoric acid, are much more easily reduced to monophosphates than the compounds arising from the monophosphates.

On soils richer in ferro- and ferri-compounds (ferro- and ferri-sulphates occur but seldom) such superphosphates ought to be employed in which the phosphoric acid is mostly, or exclusively, present in the form of free-phosphoric acid. The whole metamorphosis of the soluble phosphoric acid takes place in the upper layers of the arable land. In soils poor in chalk this fixation proceeds much more slowly, in those rich in chalk more quickly. Deeper than 30 *cm. there only penetrates a small proportion of the phosphoric acid which has been applied to the surface. The soluble phosphoric acid in the soil does not long remain as free acid, but is transformed into insoluble compounds.*

The more intensively the biochemical processes in the soil take place, the quicker the compounds not soluble in water are transformed into soluble forms. The breaking down of the newly-formed insoluble phosphates, is owing to the activity of the different groups of bacteria, of different species, and depends upon the nature of the micro-organisms and on the metabolism of their energy and their substance and also upon the quantity and disintegrating power of the organic matter in the soil. It is most of all the intensity of the processes of assimilation of the bacteria groups by which a great influence is exercised on the metamorphosis of the phosphates not soluble in water.

Our experiments have shown that very large quantities of carbon dioxide and organic acids are produced during growth in those layers of the soil in which the plant is rooted. These immense quantities of carbon dioxide and organic acid are formed by the very important vital function of all micro-organisms, that is to say by anaerobic and aerobic respiration (1).

(1) By diffusion the following quantities of carbon dioxide were given off per one hectare of alluvial soil at 14-17°C. in 200 days:

Infertile soil	36-58 q.
Soil of average quality	66-80 q.
Fertile soil	90-150 q.

In employing phosphoric acid soluble in water we must always take into account the condition of the soil. *On loamy, clayey and limy soil, a superphosphate must always be employed exclusively in which the phosphoric acid is exclusively contained in the form of free-phosphoric acid. On the contrary, on soils rich in organic matter we must make use of a superphosphate in which the phosphoric acid occurs in the form of monocalcium phosphate. If the phosphoric acid is employed in the right way and at the right time and in an adequate quantity and mixture, it may be stated that in all pot and field experiments the water soluble form of phosphoric acid always has the greatest effect.*

The good results of superphosphate do not depend on its containing phosphoric acid in a form soluble in water, but on another circumstance, *i. e.* on the facility the method of applying in a watery form offers to quick and equal distribution.

General interest attaches to the question as to which insoluble form is taken by the soluble phosphoric acid in the soil and what value is represented by the so-called soil-soluble phosphoric acid, so far as it is combined in the soil with calcium, magnesium, iron and aluminium.

The physiological value represented by the dicalcium-phosphate and dimagnesium phosphate, tricalcium and trimagnesium phosphate, ditrialuminium and ditriferriphosphate formed in the soil from the water soluble phosphoric acid, is a problem of special interest, as these are retrograde forms derived from water soluble phosphoric acid.

The experiments on plants carried out within the past two years have as a matter of fact shown us that the form in which the phosphoric acid is contain ed inthe superphosphate is not an indifferent matter. We ascertained that in the sandy soil the free phosphoric acid gave undoubtedly better results than the monocalcium phosphate. We also found the same physiological effect in a loam soil. In humus soil, on the contrary, the monocalcium phosphate gave a better result than the free orthophosphoric acid. The phosphoric acid in the forms of tetracalcium phosphate (basic slags) was not utilised as was the phosphoric acid soluble in water. Especially in the loamy

and the calcareous soil the effect was relatively small. In humus and sandy soil the favourable effect of the tetracalcium-phosphate (basic slag) was very noticeable, but at the same time fell much below the effect produced by the forms of phosphoric acid soluble in water. The hydrogenion concentration of the soil has a considerable influence (1).

If a careful examination is made of the experiments with spring oats carried out over two years, as shown in Table I, expressed in averages, it is found that water soluble phosphoric acid in the form of monocalcium phosphate and ortho-phosphoric acid have been the most effective in forming new plant-substance.

By means of analysis of the harvested dry matter, the conclusion has been reached that it was from these water soluble forms that the phosphate ion was assimilated from the greatest energy. Next to the water soluble forms of phosphoric acid the dicalcium phosphate has given good results.

TABLE I. — *Experiments with spring wheat.*

Kind of soil	Matière noire reckoned on dry matter	Monocalcium phosphate		Orthophosphoric acid	
		1.25 gm. P_2O_5		1.25 gm. P_2O_5	
	Percent	Grain	Straw and chaff	Grain	Base fertiliser
Humus soil	16.09	32.08	58.7	25.8	58.9
Lime soil	6.98	21.7	42.6	29.6	60.2
Loam soil	2.58	32.6	68.9	36.4	72.8
Sandy soil	0.58	24.3	57.9	35.2	70.3

(1) In soil of an acidity of P_H = 4-6 neutral phosphate and basic slag can be applied successfully. On soils on which the acidity rises to P_H = 3, finely ground rock phosphate, containing no fluorine, has also a good effect. Certain moorland and meadow soils are of this type.

Kind of soil	Tetracalcium phosphate		Tricalcium phosphate		Dicalcium phosphate		Base fertiliser	
	1.25 gm. P_2O_5		1.25 gm. P_2O_5		1.25 gm. P_2O_5			
	Grain	Straw and chaff	Grain	Straw and chaff	Grain	Straw and chaff	Grain	Straw and chaff
Humus soil	25.0	61.3	16.7	32.9	25.2	56.7	12.7	25.2
Lime soil	16.75	39.9	12.4	26.4	18.3	38.9	11.2	22.7
Loam soil	20.6	50.4	15.3	30.2	21.7	44.5	12.6	26.2
Sandy soil	21.8	52.4	16.2	40.7	20.8	46.7	10.8	24.3

When I was working at the chemical manufactory of Pecek, I had the opportunity of making all these compounds of phosphoric acid in larger quantities, so that I could carry out experiments on plots having an area of 1 are for several years. The experiments were made on a good loam soil which contained 1.72 % carbon in the dry matter of the fine earth. The soil was poor in calcium carbonate, there being scarcely 0.135 %. The experiments were carried out with sugar-beet and wheat. In the case of the sugar-beet I employed as base fortiliser 80 kg. nitrogen per hectare in the form of sodium nitrate and 100 kg. potash in the form of potassium chloride.

With the sugar-beet the phosphoric acid was reckoned at 50 kg. per hectare, and applied in the form of different phosphates.

For the plant experiments with wheat 60 kg. of nitrogen were employed in the form of sodium nitrate and 60 kg. potash in the form of potassium chloride. Phosphoric acid was given in different forms, 40 kg. per hectare.

The experiments were carried out on loam soil

The results of the plant experiments with sugar beets will be considered first.

After three years, average results for sugar, in kg. per ha. were ascertained.

The experiments were carried on 1 are plots. Every experiment with the single forms of phosphoric acid, as well as with the base fertiliser without phosphoric acid, always took place on

3 plots, so that the field for the experiments was divided into 27 lots.

	Sugar reckoned as kg. per ha.
Base fertiliser without phosphoric acid	2 905
Free-phosphoric acid	5 896
Monocalcium-phosphate	5 740
Dicalcium-phosphate	4 985
Tricalcium-phosphate	4 906
Monodialuminium-phosphate	5 693
Monodiferri-phosphate	5 587
Ditriferri-phosphate	4 676
Florida-phosphate	3 085

The results obtained with wheat are also very interesting. The crop harvested per hectare was estimated as follows (in quintals):

Base fertiliser without phosphoric acid	14.38
Free-phosphoric acid	30.94
Monocalcium-phosphate	25.85
Dicalcium-phosphate	23.06
Tricalcium-phosphate	20.73
Monodialuminium-phosphate	24.78
Monodiferri-phosphate	23.05
Ditriferri-phosphate	19.61
Florida-phosphate	16.19

These figures illustrate very clearly the value of the results from water soluble phosphoric acid in comparison with the retrograde phosphoric acid not soluble in water, which changes into different forms in the soil. The compounds of the retrograde phosphoric acid which, chiefly form in the soil are: dicalcium-, tricalcium-, monodialuminium, monodiferri, and ditriferri-phosphate. It should be emphasised that all these phosphates were freshly prepared, and correspond to the the vicissitudes through which the water-soluble phosphoric acid passes in the soil. Consequently the effect was noticeable, principally in comparison with the phosphoric acid found in mineral phosphates, such as, *e. g.* Florida phosphate.

It is also quite clear that the dicalcium, dimagnesium, monodialuminium and mono-

diferriphosphates are much more quickly. transformed into monophosphates than the triphosphates. Mineral Florida phosphate has shown a decidedly poor effect in the formation of the living substance of sugar beets as well as of wheat.

As early as 1898 finely ground phosphate was recommended by GUSTAV MARCK (2) in place of superphosphate for dressings. Further experiments were undertaken by PRICAISCHNIKOW, KUIERIM, DAFERT, and MIKLAUS (3) to establish whether or not the finely ground mineral phosphates could be used as fertilisers.

The writer has been occupied upon this problem for over 30 years and has arrived at the conclusion that for the physiological utilisation of the phosphoric acids the fluorine and carbonate content of the phosphates applied to the soil is of great importance. Through the action of the carbon dioxide and the organic salts given off by the bacteria, as well as through that of the carbon dioxide evolved by the root system of plants, and that of all the forms of humous acids which are present in the soil and are continually being formed from organic substances, the phosphates which are free from fluorine are much more energetically transformed into monophosphates than those phosphates which contain fluorine. The effect of the organic acids depends in this case on the fact that in consequence of their capacity for OH-ions and thereby for forming bases, they reinforce the otherwise slight hydrolytic splitting of the di- and triphosphates. It is established that the absorption of the phosphoric acids through the root system of the cultivated plants goes on much more energetically if the phosphates are without fluorine or are poor in fluorine. No phosphate containing an abundance of fluorine, if incorporated in the soil in a finely ground state, is fully utilised within the year. The physiological value of phosphoric acid in the mineral phosphates as in the soil is in the first instance dependent on fluorine content. Between fluorine and phosphorus there are certain connections. The plant experiments with lupins provide classic proof in this respect. The yield of the yellow and blue lupins was about 70 to 130% higher on application of mineral phosphates which merely contained 0.1 to 0.3 % fluorine, as against the mineral phosphates which contained 3 to 4 % fluorine, as for example, Florida and Gafsa phosphate.

The inference from my experiments is clear that by the re-

moval of the fluorides and carbonates from the mineral phosphates a complete metamorphosis in the constitution of the phosphatic substance is effected.

The following facts are undoubtedly of great interest: if basic slag is smelted with calcium fluoride, so that the phosphatic mass contains 5 to 6 % fluorine, the phosphoric acid of this mass when finely grounds is only with great difficulty soluble in citric acid. From the action of carbon di-oxide on phosphate mixed with water it was shown that the more fluorine was contained in the phosphates, the less readily was phosphoric acid transformed into monophosphate.

By the removal of the carbonate and fluoride, the calcium and magnesium phosphate become easily attacked by the carbon dioxide given off by the root system of the plant and the carbon dioxide and the organic acids given off by the bacteria, and brought into an assimilable condition.

These facts have been established by REITMAIR (4) in his observations on the effect of the new Reformphosphate. By the quantities of sulphuric acid which he applied for the destruction of the carbonate contained in raw phosphate, REITMAIR has succeeded in effecting a remarkable rise in the degree of dispersion of the particles of a phosphate and a displacement of the mineral structure. The plant experiments with the Reform phosphate which REITMAIR has instituted, show with great clearness the immense differences in effect between the soft and the hard phosphates, as well as the coarse and the fine phosphates, and moreover throughout a remarkable result obtained from the new Reform phosphates, which surpasses the former type in its raw material, and approaches the effect of superphosphate.

As regards the removal of the fluoride from the mineral phosphates FRITZ HELLER has carried out investigations on a large scale in Kasniov, in the works of Joh. Dav. STARCK, Prague, and has also had his process patented. Phosphate from which the fluorine and the carbonate have been removed by sulphuric acid is put on the market by the firm as *neutral phosphate*.

The writer has obtained some excellent results in plant experiments carried out on different crops with neutral phosphate. If it is proposed to break down the mineral phosphates which are rich in fluorine, *e. g.* apatite, Florida- or Gafsa-phosphate, etc., it is observed that within two months 6 % at most of the total phosphoric acid

in the water is dissolved in the current of carbon dioxide which is passed through the water, where are found the raw phosphates in fine particles. If the fluorine and the carbonate have been removed from the apatite, the Florida- and Gafsa-phosphates, from 82 to 88 % of the total phosphoric acid of the phosphate is dissolved within two months in the water containing a continuous supply of carbon dioxide in solution.

The plant experiments carried out in the greenhouse as well as on the experimental plots were very successful, and the conclusion was reached that the neutral phosphate was a phosphatic fertilizer of great importance and future.

The results are given below of the plant experiments carried out in sandy, loam and humus soils and in unglazed cylindrical containers made of clay. The sandy soil contained 0.52 % calcium carbonate, 2.84 % iron oxide and 1.65 % organic substances. The loam contained 1.8 % calcium carbonate, 2.73 % iron oxide and 4.2 % organic substances. The humus soil contained merely traces of calcium carbonate, 3.95 % iron oxide and 12.8 % organic substances.

The P_H of the soils was found to be: sandy soil, 6.83, loam, 7.05, humus, 5.88.

In sandy soil the sprouted seeds weighed 18 mg., loam soil 58 mg. and humus 23 mg. per 1 gm. of soil.

The respiration intensity was studied in the different soils, that is to say for 1 kg. of soil containing 25 % water, at a temperature of 20°C. and through which was passed 20 litres of air free from carbon dioxide and bacteriologically pure, in 24 hours. The experiment lasted 25 days, and showed:

In	sandy soil	an	intensity	of	28.2	mg.
»	loam	»	»	»	36.4	»
»	humus	»	»	»	32.7	»

For all pot cultures the base fertiliser applied was a mixture of 1.7 gm. sodium nitrate and 2.3 gm. potash in the form of potassium chloride.

For the first series of experiments only nitrogen and potash were used.

For the other series phosphorus was added to the base fertiliser and in the following forms: I. Gafsaphosphate, II. Monocalciumphosphate, III. Orthophosphoric acid, IV. Basic slag and finally, V. Neutral phosphate.

To each pot culture was applied 2.2 gm. P_2O_5. The seed used for the purpose was Bohemian barley.

Experiments with Barley.

TABLE II. — Sandy Soil:
Average yield in dry matter from 10 *pot cultures:*

	Grain in gm.	Straw, etc., in gm.
Without phosphoric acid . . .	68.3	154.2
Gafsa phosphate	75.3	158.7
Monocalcium phosphate	150.7	265.9
Free-phosphoric acid	268.5	284.3
Basic slag	132.3	250.7
Neutral phosphate made from Gafsa phosphate	156	294.0

Loam: *Average yield in dry substance from* 10 *pot cultures:*

	Grain in gm.	Straw, etc., in gm.
Without phosphoric acid . . .	88.3	180.5
Gafsa phosphate	105.7	201.9
Monocalcium phosphate . . .	179.3	308.2
Free-phosphoric acid	198.5	329.4
Basic slag	134.0	221.7
Neutral phosphate made from Gafsa phosphate	178.8	325.9

Humus Soil: *Average yield in dry substance from* 10 *pot cultures:*

	Grain in gm.	Straw, etc., in gm.
Without phosphoric acid . . .	62.7	125.8
Gafsa phosphate	114.0	169.7
Monocalcium phosphate . . .	192.3	342.0
Free-phosphoric acid	181.8	327.1
Basic slag	154.7	298.8
Neutral phosphate made from Gafsa phosphate	198.6	346.5

A thorough inspection of the data obtained from the three years experiments with barley reveals the fact that the water soluble forms

of phosphoric acid have most effect in sandy soil or loam. It is in fact clear that free phosphoric acid produces the highest yield in sandy soil and loam, though its physiological effect is less in humus soil.

This phenomenon is of considerable importance, having regard to the fact that in sandy soils as well as in loam and humus soils, the finely ground raw and Gafsa-phosphate produced only a very slight physiological effect. On the other hand the neutral phosphate produced by removal of the fluorine and carbonate not only surpasses raw phosphate in its effect, but it still further outdistances basic slag.

These results of three years' experiments with barley are very instructive and confirm our observations made in connection with the study of the influence of bacteria on the solubility of phosphate. It was found that phosphates after removal of the fluorine are so much transformed (7) that under the influence of bacterial secretions the water-insoluble phosphates very easily change into the water soluble forms. During the changes that take place in the water-insoluble forms of the neutral phosphate, hydrolysis takes place very rapidly. The energy of the decomposition and of the transformation into monophosphates is set up in the first place by the bacteria which assimilate nitrogen in its pure form and then by the ammonia bacteria, but mainly by the bacteria belonging to the root area in the barley.

The root system of barley (8) has a remarkably sensitive reaction to the different forms of phosphoric acid in the soil. Not only the carbon dioxide given off by the root system of the plants but also the bacteria of the root areas have a marked capacity for breaking down the water insoluble forms of phosphoric acid. If the phosphates contain much calcium carbonate, the breaking down process goes on very slowly.

Both the accurate tests for growth and the numerous experiments carried out in the plots during two years with the different cultivated plants and especially with wheat, rye, potatoes, sugar beet and mangolds furnish evidence that superphosphate in the physiological value of its phosphoric acid surpasses that of all other modern phosphates.

Some experiments may be quoted here made by the writer with sugar beet, grown in a loam containing 1.8 % calcium carbonate.

Experiments with Sugar Beet.

The results from the separate experimental plots have been reckoned per hectare.

62 kg. of nitrogen in the form of Chile nitrate and 80 kg. potash in the form of potassium chloride were applied as base fertiliser. On some plots in addition to the base fertiliser, 52.5 kg. phosphoric acid was applied in the form of superophosphate and neutral phosphate. The results are as follows:

Yield of beets per hectare:

Unmanured, 238 quintals with a sugar content of 16.58;

Base fertiliser, 272 quintals with a sugar content of 17.37;

Base fertiliser, with superphosphate, 366 quintals with a sugar content of 18.8;

Base fertiliser with neutral phosphate 360, quintals with a sugar content of 18.5.

These figures show clearly that the superphosphate has had a very decided effect on the yield in beets and has greatly assisted the formation of sugar, and also that the neutral phosphate comes very close to it in physiological effect.

The conviction has been reached on the basis of many years of experience in the study of the physiological effect of the phosphoric acid in the different phosphates, *that, of all the phosphates which contain phosphoric acid in a water insoluble form, the phosphoric acid in neutral phosphate is the form which most effectively increases production of new living plant substance. In consequence, neutral phosphate can satisfactorily replace basic slag as a plant food material,* especially for leguminous crops and for the tillage of meadow and forest land.

The physiological results obtained by neutral phosphate show clearly that the application of citric acid affords no trustworthy criterion for ascertaining the results of phosphoric acid in the different phosphates. Citric acid does not belong so far as is known to the type of acids which are usually found in the different soils. It was selected by the writer in the first place because it resembled the acids of the cell sap. Further experiment has shown that the P_H content of the cell sap in the root system varies from 6 to 7. The only acid which forms when sufficient oxygen is present, and is given off by the respiratory process of the root system of plants, is carbon dioxide.

Carbon dioxide in solution is the best agent for giving some partial indication of the capacity for absorption of the phosphate ion of the different phosphates, through the root system of the plants.

In experiments on the physiological value of the phosphoric acid in the different phosphates, the choice of the plants to be used in the experiments is of great importance.

It has been known for some time that the phosphate-ion is not absorbed from the soil in the same way and in the same time by the root systems of the different cultivated plants. With a view to obtaining reliable data, plant experiments have been undertaken on our experiment plots and in particular with *Triticum vulgare, Hordeum vulgare, Avena sativa, Pisum sativum, Vicia Faba, Lupinus luteus, Trifolium pratense, Medicago sativa, Solanum tuberosum, Beta vulgaris.* The soil was of uniform fertility and remained unmanured. The results were calculated on a hectare of ground in each case.

The nitrogen- phosphoric-acid and potash content of the whole plant (aerial and subterranean parts alike) was determined in the first instance after 60 days growth and secondly at the end of the vegetation cycle. The average results of three years observations are the following:

Phosphoric acid content of the whole plant after 60 *days growth:* —

Hordeum vulgare	26.84 kg.
Triticum vulgare	29.93 »
Avena sativa	32.08 »
Beta vulgaris	34.27 »
Solanum tuberosum	30.58 »
Trifolium pratense	20.12 »
Medicago sativa	21.84 »
Lupinus luteus	18.74 »
Vicia Faba	23.64 »
Pisum sativum	18.16 »

Phosphoric acid content of the whole plant at the end of the vegetation cycle.

Hordeum vulgare	42.58 kg.
Triticum vulgare	46.27 »
Avena sativa	38.54 »
Beta vulgaris	51.84 »
Solanum tuberosum	50.06 »
Trifolium pratense	58.73 »
Medicago sativa	64.89 »
Lupinus luteus	40.55 »
Vicia Faba	71.46 »
Pisum sativum	45.43 »

The phosphoric acid content of the whole plant amounted accordingly, after 60 days' growth, expressed in % of the total phosphoric acid to:

Hordeum vulgare	63.03 %
Triticum vulgare	64.68 %
Avena sativa	82.23 %
Beta vulgaris	66.11 %
Solanum tuberosum	61.08 %
Trifolium pratense	34.25 %
Medicago sativa	33.65 %
Lupinus luteus	46.21 %
Vicia Faba	33.08 %
Pisum sativum	39.97 %

From this survey it is evident that the eared crops, i. e. Hordeum vulgare *and* Triticum vulgare *re-absorb* 63-64 % *of the total phosphoric acid from the soil within* 60 *days, while* Avena sativa *re-absorbs* 83 % *of the total phosphoric acid in* 60 *days.* Beta vulgaris *and* Solanum tuberosum *re-absorbed in* 60 *days, similarly,* 61 *to* 66 % *of the*

total phosphoric acid. The leguminous plants form an exception as in their case the quantity of phosphoric acid re-absorbed in 60 *days is not so great, amounting to* 33-46 % *of the total phosphoric acid.* These results harmonize completely with farming practice, as we note that the leguminous plants possess the greatest capacity for utilising rock phosphates which contain phosphoric acid in a highly insoluble form, because at the commencement of their growth they do not require so much phosphoric acid for building up the living plant structure.

For the appraising of the utilization of phosphoric acid from the different phosphates, the plants with which experiments are made are of great importance. In any case the cereals have to find phosphoric acid in the soil in an easily assimilable form, which is also true of *Beta vulgaris* and *Solanum tuberosum*. The leguminous plants can on the contrary, as has been already mentioned, make use of highly insoluble phosphates, as through their biochemical activity in the soil the triphosphates are gradually transformed into monophosphates.

SUMMARY.

Experiments carried on over a number of years in manuring with the different forms of phosphoric acid have led to the following results :

(1) It is by no means a matter of indifference in which form the water soluble phosphoric acid appears in the superphosphate.

The free-phosphoric acid has decidedly a better effect than the monocalcium phosphate when used on sandy loam and chalk soils; on the other hand, the water soluble form of the acid as monocalcium phosphate stands the test better on humus soil. It follows from this that the superphosphate factories should manufacture for use of sandy soil, loam and chalk soils, a superphosphate in which the phosphoric acid is chiefly available as free-phosphoric acid ; this is very easily broken down by an excess of sulphuric acid.

(2) The water-insoluble phosphoric acid found in any form in the different types of phosphates now on the market has less physiological value than the water-soluble forms in superphosphate.

(3) The water-soluble phosphoric acid so acts in the soil that the seedlings find at once within the area tapped by their roots the phosphoric acid in assimilable form. This is of great

biological importance, because the phosphorus can be utilized in the early stages of plant development for the building up of the new cell substance.

(4) Phosphorus is not only required for the formation of the cytoplasm and caryoplasm, but for the building up of chlorophyll in the cells containing chlorophyll. (1)

(5) Phosphorus, together with potassium and magnesium, takes a very important, part in the processes of photosynthesis, which are closely connected with the building up of chlorophyll in the plant cells.

JULIUS STOKLASA,
Director of the State Experiment Station for Plant Production, Czecho-Slovakia, and Professor of the Higher Technical School, Prague.

BIBLIOGRAPHY.

JULIUS STOKLASA. O monocalcium fosfatu. *Kral. učerná spol. nauk.* Prague, 1890.

O monomagnasium fosfatus. *Parts I and II, der Wissenchaften.* Prague 1892.

Chemické a fisiologické studie o superfosfatech. Prague, Pub. by Rivnae, 1893.

Die landw. Versuchsstationen, Berlin, 1890-95.

Bericht d. bömischen Akademie für Kunst. u. Wissenschaften, 1893.

Bericht d. konigl. böhm. Ges. d. Wissenschaft in Prague, 1888-92.

Zeitschrift f. anorg. Chemie, Hamburg, 1892.

Zeitschrift f. analyt. Chemie, Wiesbaden, 1890.

(1) My assistants URBENSKY and BORISOV obtained from their investigations with approximately 1400 soils from the Czecho-slovakian Republic, the following results. The electrometric method was employed, as the colorimetric method gives unreliable results.

Active acidity:

PH = 4-5	1.68 % in the soil
PH = 5-6	12.63 » » »
PH = 6-7	42.30 » » »
PH = 7-8	40.03 » » »
PH above 8	3.36 » » »

Exchangeable acidity:

PH = 3-4	4.24 in the soil
PH = 4-5	35.60 » » »
PH = 5-6	33.02 » » »
PH = 6-7	22.90 » » »
PH = 7-8	3.39 » » »
PH above 8	0.85 » » »

Listy chemike, Prague, 1888-94.

Casopis pro prumsyl chemicky, Prague, 1894.

Oester-ungar. Zeitschrift. f. Zuckerindustrie, u. Landwirtschaft, Vienna, 1894.

Bericht d. oesterr. Gesellschaft z. Förderung d. chem. Industrie, Prague, 1887-91.

Mitteilungen d. Verein z. Forderung d. landw. Versuchswesens in Oesterreich, Vienna, 1891-94.

Oester. landw. Centralblatt. Graz, 1891.

Annales agronomiques, Paris, 1900.

Chem. u. Phys Studien über die Superphosphate. P. Parey, Berlin, 1896.

Biochemischer Kreislauf des Phosphations im Boden, G. Fischer, Jena, 1911.

Ueber den physiologischen Wert der bodenlöslichen Phosphorsäure. Vienna, 1892.

Ueber den Einfluss der Bakterien auf den Lösungsprozess der Phosphate im Boden. *Zentralblatt f. Bakteriologie, Parasitenkunde und Infektionskrankheiten*, G. Fischer, Jena, 1924.

Nouveau progrès dans l'amélioration de la terre arable. *Institut International d'Agriculture*. Rome, 1923.

Nouveau progrès dans la fertilisation de la terre arable. *Ann. de la Science agronomique française et étrangère*, Publishers, Max Berger-Levrault, Nancy-Paris-Strassbourg, 1923.

Influence des microbes sur la résorption des éléments biogènes du sol. Académie d'Agriculture de France, 1924.

Methoden zur biochemischen Untersuchung des Bodens, *Handb. d. biol. Arbeitsmethoden*, Abderhalden, Urban u. Schwarzenberg, Vienna, 1924.

Ziele der modernen Forschung in der Biochemie des Bodens. *Deutsche landw. Presse*, Nos. 48 and 49, Paul Parey, Berlin, 1924.

Die modernen Ziele der biochemischen Forschung des Bodens. " Chemie der Zelle und Gewebe " Gebrüder Borntraeger, Leipzig, 1924.

Ueber die Resorption der Ionen durch das Wurzelsystem der Pflanze aus dem Boden. *Ber. d. deutsch. bot. Ges.*, 1924. Vol. XLII, *D.* 5, 1924.

Influence des microbes sur la résorption des éléments biogènes du sol. Acad. d'Agriculture de France, Paris, 1924.

La radioactivité des gaz éruptifs du Vesuve et des solfatares de la Campagne, etc... *C. R. Séances Académie des Sciences*, Paris, 1924.

GUSTAV MAREK. Ueber den relativen Düngerwert der Phosphate. G. Schönfeld, Dresden, 1889.

DAFERT and MIKLAUZ. *Zeitschrift für das landw. Versuchswesen in Oesterreich*, 1917, 1918.

REITMAIR. Die Wirkung des neuen Reformphosphates. *Zeitschrift f. d. landwirtsch. Versuchswesen in Deutsch-Oesterreich*, vol. 5, 1922, p. 1.

THE CHILEAN NITRATE INDUSTRY.

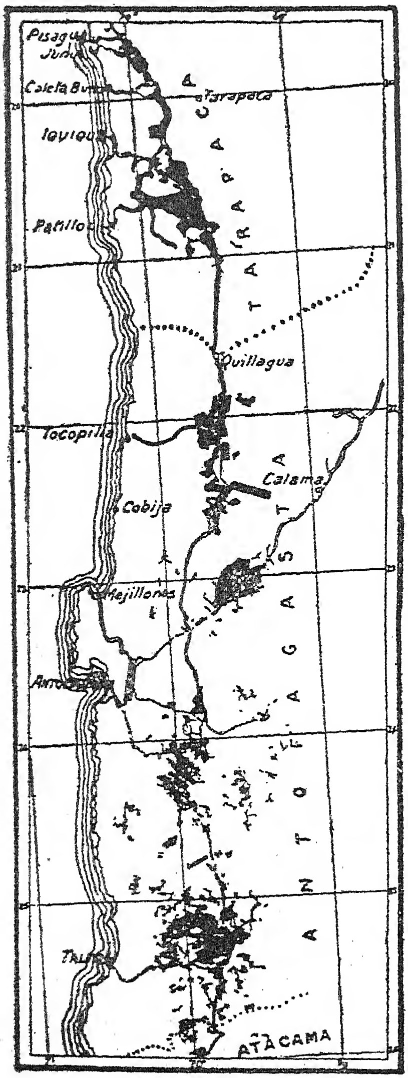


FIG. 143. — Map of nitrate region.

Nature has collected, it might be thought for contrast, large quantities of a very valuable substance in one of the most arid and inhospitable regions of the world. This substance can restore to the soil lost fertility, and can assist humanity by increasing crop yields. By the aid of chemistry many other materials of the greatest utility can be derived from this product, e. g, explosives, which reduce the cost of sextracting metals and combustible materials, from the soil, and which are of great assistance in making tunnels and constructing bridges; in the manufacture of artificial dyes of varied and permanent colours, never before obtained; in the making of compounds employed in the alleviation of human pain.

In the northern part of Chile (19° to 26° South latitude, and 70° West of Greenwich) (fig. 143) there are for a distance of about 50 kilometres, beds containing great masses of useful materials, such as nitrate of soda or Chilean nitrate, common salt, sulphate of soda, borax, sulphate of aluminium, etc. One cannot fail to receive a very deep impression

PLATE LXIV.

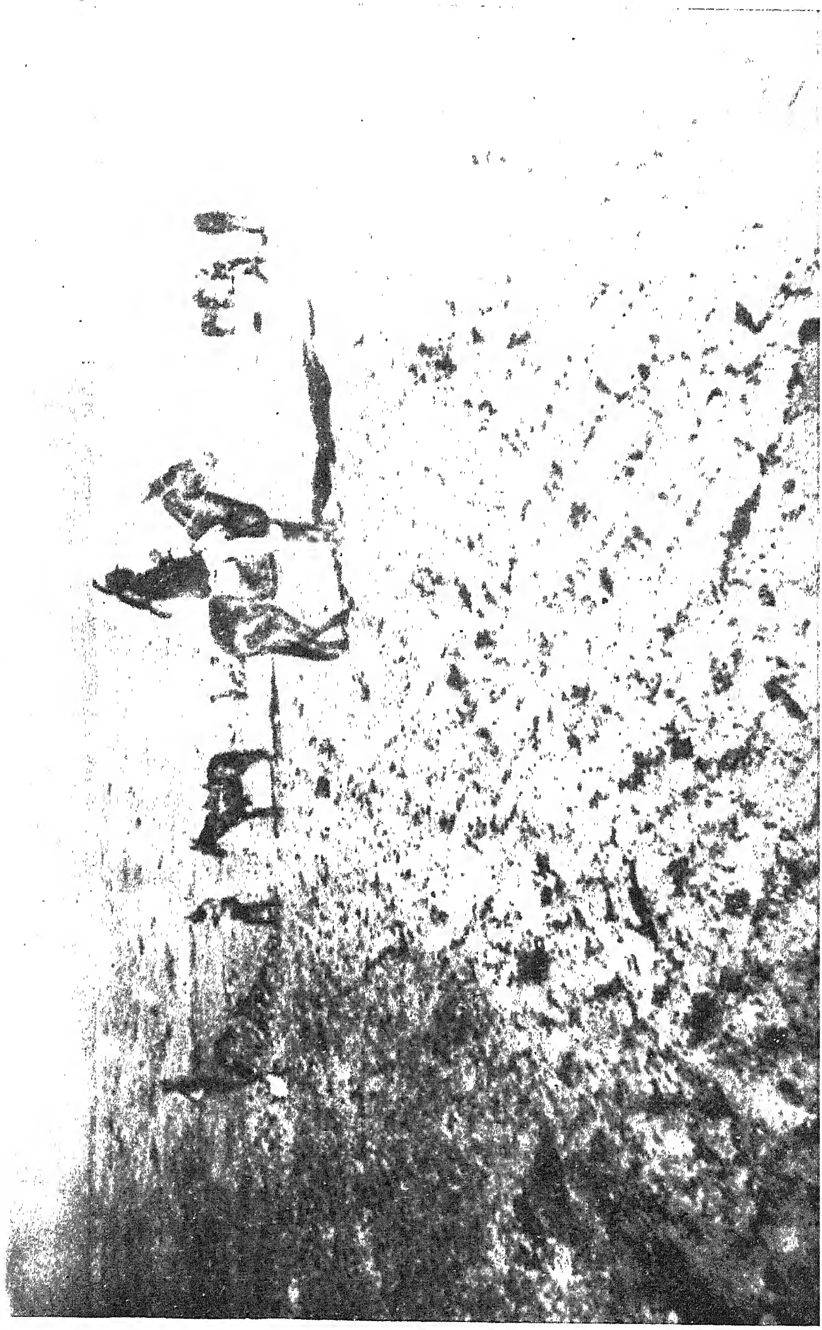


PLATE LXV.

FIG. 145. — Garden and management offices in the middle of the Pampas.

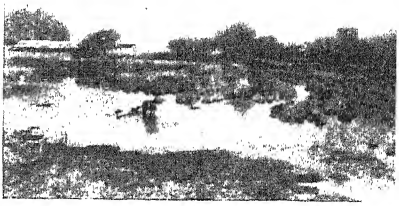


FIG. 150. — The river Loa.

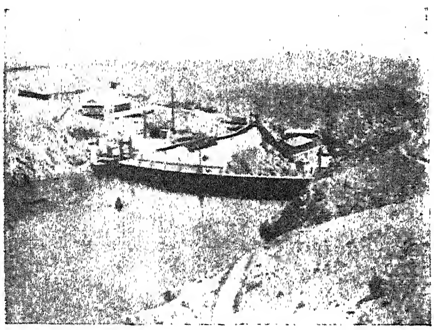


FIG. 151. — Channel of the river Loa and dam of the Nitrate Company of Tocopilla.

FIG. 152. — Vegetation on a spur of the C lera de los Andes.

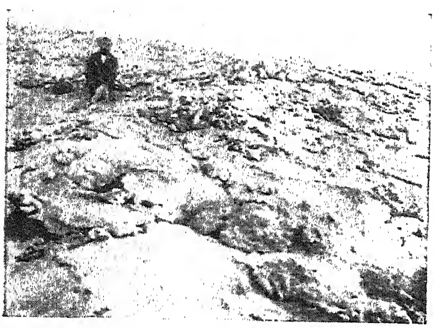


FIG. 155. — View of a "salar", in nitrate zone.

FIG. 156. — View of a salar.

from this region, situated between two precipitous mountain ranges, far from the coast, completely deprived of vegetation, water, combustible materials, of everything that is necessary to human life. A very wide, lonely, silent country, burnt up by the tropical sun (fig. 144, Plate LXIV), the elements consuming, little by little, the rugged outlines of the mountains; at noon sultry heat, clear and cold nights, never ceasing winds. If to-day you travel by railway or motor-car over the whole Pampas, if after the day's work you rest in the offices of the Nitrate Company (fig. 145, Plate LXV), with all their modern comfort, you must perforce think of the enterprize, perseverance and courage of the first discoverers of the nitrate pampas and of the capital required to create and develop such an industry.

It has been necessary: to organize life where nature was adverse, to create towns, villages, harbours, roads and railways; to find water at a distance of hundreds of miles in the Andean Cordilleras, to import from other parts of the world the combustible materials necessary for the work, the materials for building, food for people and forage for the live stock.

The Chilean nitrate industry is also economically interesting. The output of sodium nitrate (fig. 146) has reached in the last twenty years, an average of 2.5 million metrical tons annually, containing about 400 thousand tons of pure nitrogen with a value of 300 million Chilean gold pesos; the greatest production being in 1916 with 3 million tons. Since January 1830 to January of the present year the exportation has been 70 millions tons containing about 11 millions tons of nitrogen. Considering that the increase in the commercial price of nitrogen, like that of other products, is five times the former rate, it can be said that in the above period the Chilean nitrate industry has contributed about 42 *thousand million Chilean gold pesos* to the world's wealth.

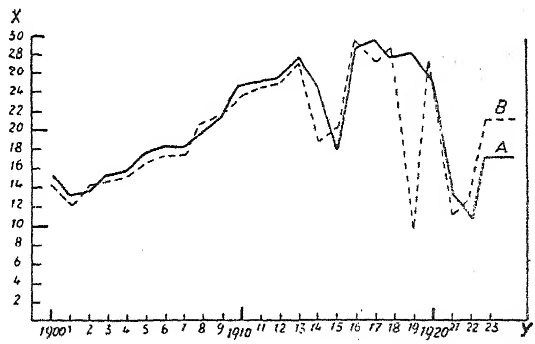


FIG. 146. — Production and exportation of Chilean nitrate.

The above industry has also produced (January 1880-January 1925) 17 500 tons of iodine with a commercial value of about 300 million gold pesos.

The exportation of another sub-product, perchlorate of potash, was, during the last 10 years, a million kg.

The production of the nitrogen industry is now 4454 thousand tons annually, divided as follows:

Chilean producers	68 %
English producers	23 %
Yugo-slavonian producers	2 %
North American, German and French producers.	7 %

The nitrate industry pays to the Chilean exchequer, besides other contributions, an exportation tax of 33.38 Chilean gold pesos for each ton of nitrate and 1.27 gold pesos for a hundred grams of iodine. From the day in which those taxes were established, that is from the first of January 1880, to the first of January 1924, the exchequer has received: from taxes on nitrate 2 076 416 000 Chilean gold pesos, from taxes on iodine 22 026 000 Chilean gold pesos.

The value of nitrate land sold by the State for the extraction of nitrate amounts to more than 50 000 000 Chilean gold pesos.

In the nitrate region are about 150 establishments connected with the industry, known as *oficinas salitreras*; the nitrate lands, the machinery and implements are worth more than 500 million gold pesos. This sum is greatly increased by the value of railways, water installations, warehouses and accommodation at the harbours, telephones, etc.

The nitrate industry employs a great deal of labour; 50 000 persons are engaged in the work of extracting and elaborating the nitrate, and as many are employed in the auxiliary work. It may be said that the 400 000 inhabitants of the nitrate region get an immediate or indirect gain from the above industry. The comfort and the prosperity of their life gives them compensation for an occupation carried out in an arid, burnt up region; the industry makes this area the most important part of the country.

The industry requires annually :

250 000 tons of coal,
750 000 " " petroleum,
50 000 " " blasting powder

and a great deal of dynamite and thousands of tons of iron and steel.

The following are required annually for food :

15 000 head of cattle
15 000 tons of flour
10 000 " " potatoes
3 000 " " farinaceous products.

To feed the live-stock of the region 20 000 tons of corn and 30 000 tons of forage are imported.

At the present time there is a great demand for chemical products, of which nitrogen is very important. The requirement for nitrogen increases each year at a ratio greater than that of production, and in consequence there is a deficiency that it is almost impossible to meet.

The demand for nitrogenous products to-day, is such that it would not be sufficient to return to the soil merely the amount of nitrogen removed in the form of crops. Experience has shown that, to reduce the cost of human food, the amount of nitrogen applied to the soil must be notably increased, to the extent of double or triple the highest applications now given.

This highest application has been reached by Belgium with 76 kg. of nitrogen per hectare-year of cultivated soil. In spite of her attempts, Germany has not attained 65 kg per hectare-year. But these figures will probably increase to a marked extent in every country, owing to propaganda on this subject.

Half a million tons of pure nitrogen has been used during the last ten years ; during the War the quantity consumed was one million three hundred thousand tons ; only half this amount was required after the Armistice. We are now, slowly but surely, reaching a consumption, of a million tons.

Of the nitrogen consumed throughout the world, Chilean nitrate

always supplied a very important part (fig. 147). This exceeded 50 % until 1914; afterwards this percentage diminished because of the synthetic nitrogen industry and the disturbances in the trade of the world.

In 1923 the following amount of nitrogenous products were used :—

Chilian nitrate	305	thousand	tons,	32.2 %	of total
Sulphate of ammonium from coal	232	,,	,,	24.5 %	,,
Synthetic ammonia . . .	250	,,	,,	26.4 %	,,
Cyanamide.	141	,,	,,	14.9 %	,,
Nitrate of calcium . . .	19	,,	,,	2 %	,,

Notwithstanding the changed conditions mentioned above, there are many reasons why the Chilean nitrate industry should regain its former position.

(i) Enormous beds ensure a maximum production of 3 millions tons during several centuries;

(ii) The cost of production of nitrate may be reduced owing to improved methods of extraction;

(iii) The export taxes may be altered or lowered.

FIG. 147. — Production of nitrogenous compounds in thousands of tons of nitrogen.

A) Nitrogen as nitrate of soda.
B) Synthetic nitrogen and its products.
C) Total nitrogen for the world.

Until 1914 the nitrate industry maintained its leading position, producing the maximum and selling advantageously; the price of nitrate of soda fixed the price of nitrogen all over the world, but the subsequent changes in the nitrogen industry altered everything and brought about the foundation of a society, the *Asociación de productores de salitre* that has methodically organized the industry, controlling the sales, advertising and improving the position of the working class, in order to avoid strikes and the emigration of workmen.

At the same time the working methods have been improved; some improvements, introduced during the last ten years, allow a better use of the raw material; new processes, to be introduced without delay, have been discovered and tried. That is the part of the nitrate technique in which chemists are mostly interested and that is especially considered in the present article.

The nitrate lands of Chile extend about 30 km. West and 120 km. East from the meridian 70° West of Greenwich, the distance between the north and south limits being about 630 km. The region can be divided into four parallel, perfectly defined zones (figs. 148 and 149),

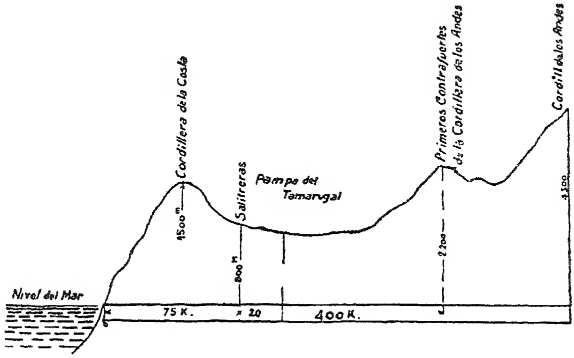


FIG. 148. — Section of the nitrate area in the Tarapaca zone.

the *Cordillera de los Andes* and the Andean uplands. The Cordillera that is parallel to the coast is a bare and precipitous barrier, with

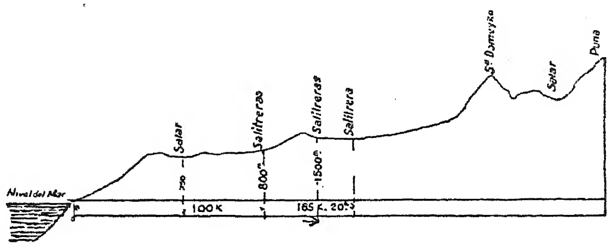


FIG. 149. — Section of the nitrate area in the Antogafasta zone.

narrow areas, higher and vertically cut on the northern part, destitute of vegetation, containing in the highest parts small deposits of common salt, chloride of potash and nitrate of soda.

This barrier is divided into four parts by deep ravines leading to the interior valley (figs, 150-151, PlateLXV); the Tiviliche ravine (Pisagua), the bed of the river Loa, the Blanca (Antofagasta) ravine and the Taltal ravine. This Cordillera has an average breadth of 60 km. and an average elevation of 1000 to 1200 m., attaining in some points 2000 m. Towards the interior of the country the slopes are easy, forming round, small hills, as far as the upland longitudinal valley. This forms the second zone, from north to south, bending somewhat towards the east in Antofagasta and presenting a succession of valleys in Taltal, in the southern part of the nitrate land, with a very variable breadth of 20 to 100 km. The third zone is formed by the buttresses of the Cordillera de los Andes, comprising fertile valleys with sufficient water and vegetation (fig. 152, Plate LXV), and small villages, real oases in the desert. Then are found the Cordillera de los Andes with summits of more than 5000 m., with deposits of sulphur, borax, carbonate of soda, common salt, etc., with perpetual snow that produces small streams that disappear in the valley, excepting the one which becomes the river Loa and after a long winding course flows into the sea.

The nitrate deposits are situated on the internal eastern slope of the Cordillera de la Costa at the same height as the longitudinal valley, forming a range of hills which disappear at a greater elevation. The deposits follow the gentle slopes of the Cordillera de la Costa excepting the Taltal region, in the southern part of which they are found on the hill summits.

The nitrate of soda is mixed with other salts and th insolublewi substances, forming a conglomeration which assumes various forms Small masses of saline materials, mixed with nitrate are found overlying the decomposed porphyry of the Cordillera de la Costa. These unimportant deposits belong to the oldest formations; the more interesting deposits, those that are industrially exploited, are stratified. At a certain depth there have also been found deposits (figs. 153-154, and 155-156, Table LXV) filling cavities of the Cretaceous formation and composed of high grade mate-

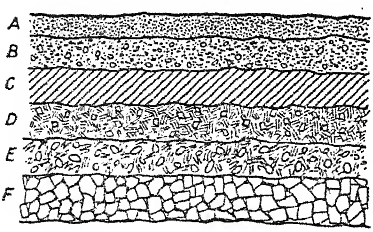


FIG. 153. — Ideal section of the nitrate beds: A "chuca", B "costra", C"caliche", D "congelo 'E "coba", F bed rock of the cordillera.

rial, but these deposits are not plentiful and are difficult to extract. The stratified deposits belong to two types; the oldest have the following formation:

Covering stratum	. . . .	*chuca* / *costra*
Profitable ,,	. . . .	*caliche*
Lower ,,	. . . .	*conjelo* / *coba*

Under the *coba* lies the rock of the Cordillera de la Costa.

The surface of the soil is dusty and covered by dry, flat stones, called *lajas* or *lozas* and sometimes by pieces of flint termed *mellizos*. The *chuca* is always white or grey loose earth, formed of Thénardite (Na_2SO_4) mixed with sand and clay.

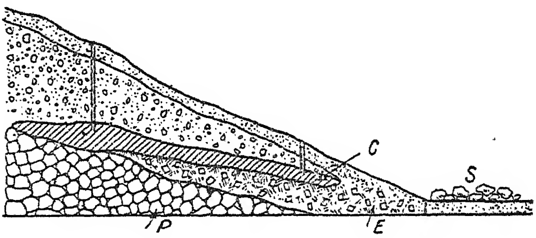


FIG. 154. — Arrangement of the strata in the nitrate formation: C "caliche", E "coba", porphyry, Sh "salar".

The *costra* is a conglomerate containing nitrate of soda in such a ratio that its extraction is not economical, insoluble materials, and chloride and sulphate of soda.

The *caliche* is the profitable layer and is formed of a mixture of salts soluble in water, and of insoluble and inert matter; there is a large proportion of nitrate, which seems to hold together the insoluble materials.

The *caliche* is formed of the following salts :—

(1) Nitrate of sodium, potassium, calcium and magnesium;

(2) Chloride of sodium, potassium, magnesium;

(3) Sulphate of sodium, calcium, magnesium and aluminium;

(4) Perchlorate of potassium;

(5) Iodine compounds = Iodate of calcium $Ca(IO_3)_2$ and iodochromate of sodium = $7\text{-}Ca(IO_3)_2 + 8\ CaCrO_4$ = Dietzite.

The insoluble material consists of rock, sand and clay.

The internal strata are unimportant; the *conjelo* is principally

formed of chloride and sulphate of sodium with a few insoluble materials,

The *coba* is a layer of loose, rather damp earth, mixed with small stones. This formation is often found on the gentle slopes of the Cordillera de la Costa, at a certain part of the valley and finishes at a higher point. The lower part of the deposit is always shallow and of a good grade ; as it rises, the depth increases and the grade diminishes. There are also other deposits, termed *caliches de salar* in the lowest part of the soil with a small covering of *chuca* and containing a great deal of salt. The *costra y caliche* strata are not found as their place is taken by an intermediate layer called *caliche costroso.*

These *caliches de salar* are no doubt of a later formation; they contain much chloride of sodium and nitrate and sulphate of sodium in less quantity.

In some parts of these *salares* a mineral has been found termed *Darapskita* $= Na_2\ SO_4,\ NaNO_3.\ H_2O$; the method and time of its formation is studied in another part of the present article and demonstrates the secondary origin of the *salares.* Some of these are formed at the present time in certain closed basins near the coast, where every night thick low-lying fogs occur.

The soil of the heights is damp enough to allow the waters to take to the bottom the soluble salts, which form horizontal layers owing to the evaporation during the day-time. There is also another kind of *salares* containing considerable quantities of chloride of potassium. They are formed by water that in the Cordillera de los Andes has dissolved salts of potassium and in the valley has evaporated near the nitrate formation. All these *salares* show a shrivelled surface, caused by the raising of the salt covering by expansion and contraction due to the sudden changes of temperature.

The *caliches* have different compositions, different percentages of salt, different colours and a variable physical appearance. On the whole, they are altogether dissimilar ; some are very soluble, others are almost impermeable to liquids, some produce turbid liquids that cannot be decanted, others produce clear liquids.

PLATE LXVI.

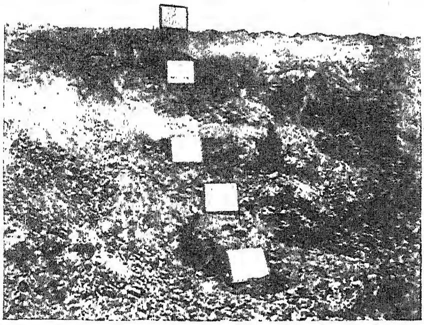


FIG. 157. — Soil section showing the different strata.

FIG. 158. — A block of strata. The numbers shc their distribution, from above downwards accor(ing to fig. 157.

FIG. 160. — Drilling by hand labour.

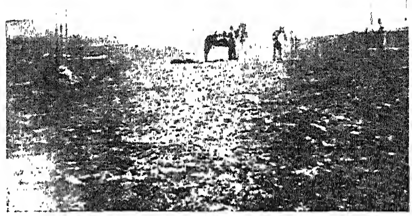


FIG. 161. — Drilling by hand labour

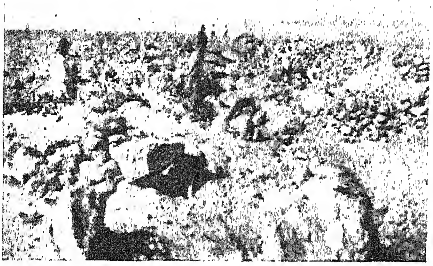


FIG. 162. — Excavating the soil and selection of nitrate material.

FIG. 163. — Mining the soil.

PLATE LXVII.

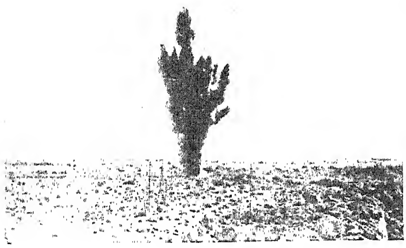


FIG. 164. — Mining the soil.

FIG. 165. — Work of a special labourer who, after removing the soil with explosives, cuts a way in the *caliche* and selects the material.

FIG. 166. — Selection of useful material.

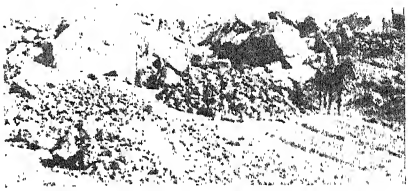


FIG. 167. — Selecting useful material.

FIG. 168. — Mechanical drilling.

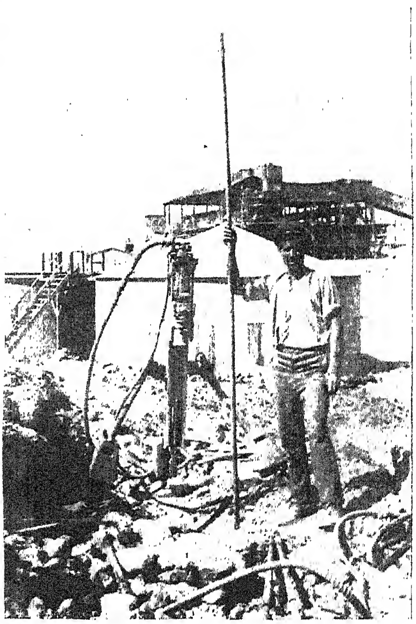


FIG. 169. — Use of drill.

FIG. 170. — Use of mechanical drill and explosives breaking down the blocks. (This work was formerly done by hand, with hammers).

FIG. 171. — Mechanical drill.

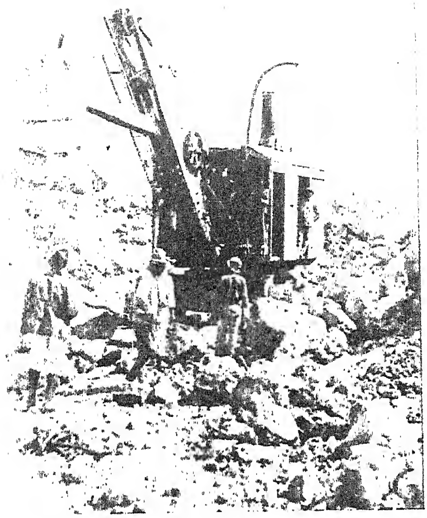


FIG. 172. — Mechanical shovel for removing the overlying strata.

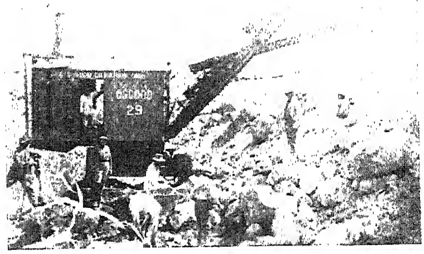


FIG. 173. — Mechanical shovel.

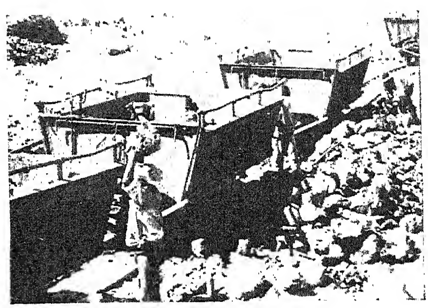
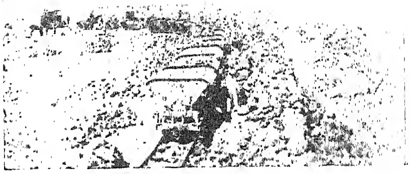
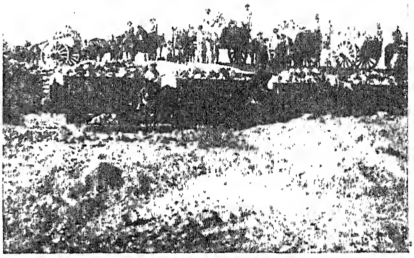


FIG. 174. — Selection and transport by railway.

PLATE LXIX.



FIGS. 175-176. — Selection and transport of nitrate.



FIGS. 177-178. — Transport by carts from the *caliches*: loading into waggons.

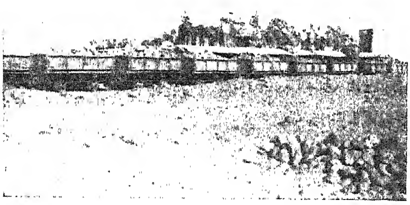


FIG. 179. — Transport of nitrate.

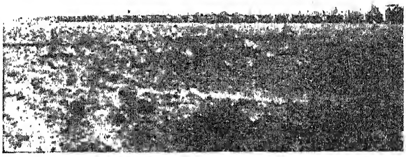


FIG. 180. — A train from the *caliches*.

PLATE LXX.

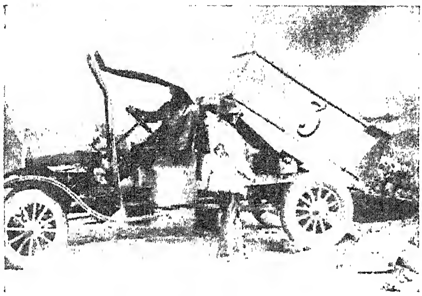


FIG. 181. — Motor-lorries which are taking the place of mule carts.

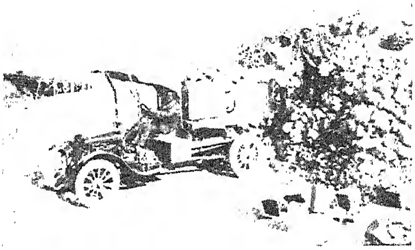


FIG. 182. — Motor-lorry loading.

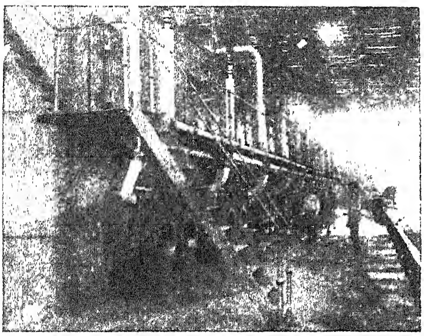


FIG. 183. — Installation of petroleum boilers of manufactory.

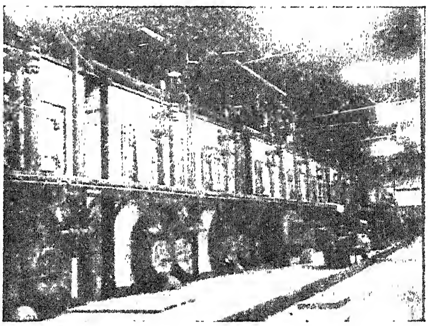


FIG. 184. — Idem.

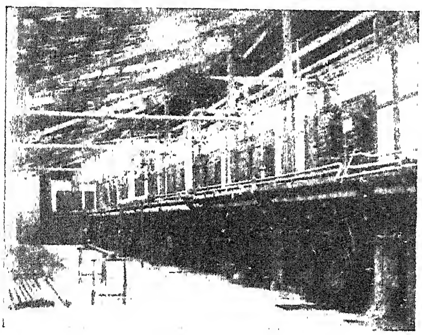


FIG. 185. — Petroleum-heated boiler station.

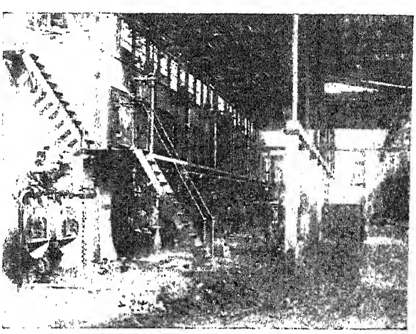


FIG. 186. — Coal heated boilers.

PLATE LXXI.

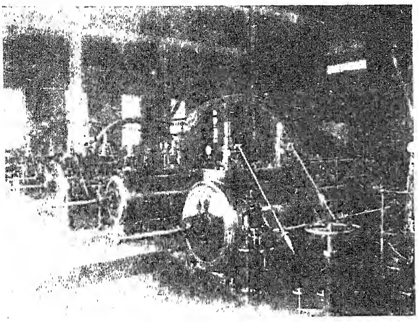


FIG. 187. — Steam engines at a nitrate central station.

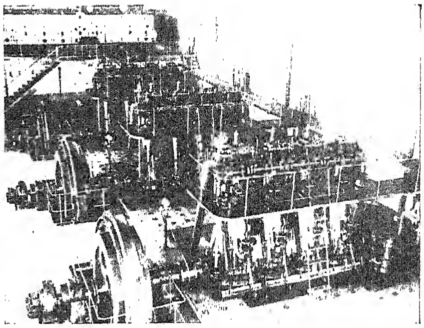


FIG. 188. — Diesel-motors of another central station.

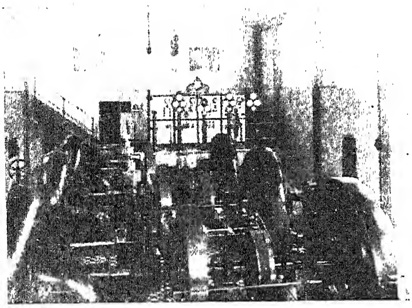


FIG. 189. — Hydroelectric central station on the river Loa, Nitrate Company of Tocopilla.

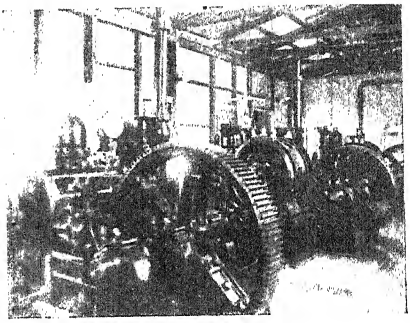


FIG. 190. — Pump installation in the river Loa for supplying water on the Pampas.

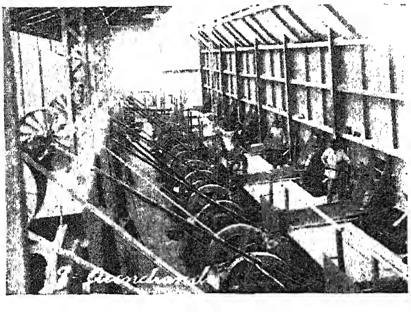


FIG. 191. — Grinding and purifying the *caliche*.

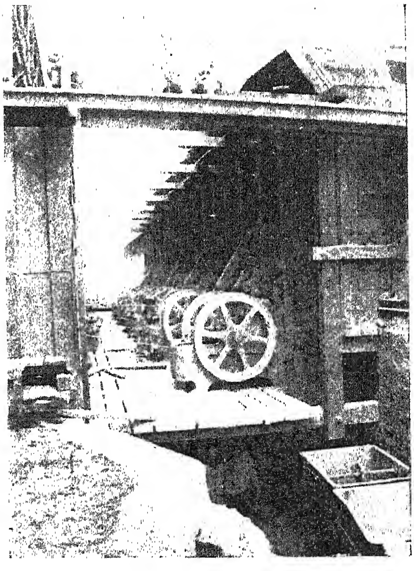


FIG. 192. — Grinding the *caliche*.

***

The nitrate deposits are exploited by mining methods. Cuttings called *catos* or *tiros* are made in the soil, which is removed with explosives; trenches are opened and the useful material is separated from the useless portion (Figs. 157, 158, Plate LXVI; fig. 159, 160, 161, 162, 163, Table LXVI; fig. 164, 165, Table LXVII). All this mining work has, during many years, been done exclusively and directly by hand, without the help of machinery. Only recently and in certain places has it been possible to drill, break and excavate by mechanical means.

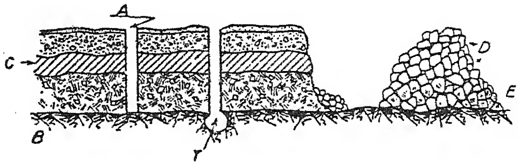


FIG. 159. — Diagram showing disposition of nitrate in the beds.
A = borehole, B = primary rock, D = "caliche", E = "costra", T = preparatory shaft.

Mechanical methods can only be used when the deposit has a uniform formation and grade, as a machine cannot select the materials. As, with the present mode of working, *caliche* is required having a definite grade, to avoid low profits it is essential that man should indicate what material has to be collected. (Figs. 166, 169, Plate LXVII; figs. 170, 171, Plate LXVIII).

A change in the method of working allowing the employment of a lower grade mineral than that used at present, — say of 10 % — would cause a real transformation and a greater use of machinery. In the Pampas, with a burning sun and clouds of dust raised by strong winds, the work can only be done by men of strong physical constitution.

The *caliche*, having been separated into grades or *acopiado*, is carried to the installation, to the *Máquina*, as it is called, where it undergoes grinding and preparation (Figs. 172-174, Plate LXVIII; figs. 175-180, Plate LXIX; figs. 181, 182, Plate LXX).

The figures 183-186, Plate LXX; 187-192, Table LXXI show boilers, steam-motors, Diesel-motors, and the hydro-electric central power station on the river Loa.

***

The mining operations are less interesting to the chemist than those connected with the *caliche*, which consist of separating

out the nitrate from other salts and insoluble substances, and in crystallizing the nitrate in a commercial form, with a purity of 95 %.

The technique for the elaboration of Chilean nitrate was devised in 1809, by a German scientist, T. HAENKEN, of Cochabamba, who was in the Spanish Service.

An outline of the separation process is :

(*a*) The selective solution of the salts, especially the nitrate ;

(*b*) the separation of the salts in solution, or *caldo*, from the insoluble salts ;

(*c*) the separation, by crystallization, of the nitrate from the other salts in solution.

In the various processes it is necessary to consider the raw material, the soluble and insoluble substances, and the residue left after treatment.

Nature who always works well, has collected in the *caliche* three principal soluble salts : nitrate, chloride and sulphate of sodium, possessing very different properties, which makes their separation comparatively simple. On determining the concentration of a saturated solution of the above salts, at different temperatures, and of one salt independently of the other, it is found that the concentration of nitrate increases greatly at higher temperatures, the chloride increases a little and the sulphate decreases. When the three salts are mixed, the concentration of each of them, at the same temperature, decreases if compared with the independent concentration. The nitrate, no doubt on account of the greater work required for its solution, has a dominating effect which is shown by the curve of the chloride solution ; in this case the salt is dissolved less by heat than in cold solution. The *caliches* do not dissolve according to the recognized curves of pure salts, or of mixtures of these salts. The curve of solution of the *caliche* salts follows only the general form of the curve. In general, the concentrations obtained are lower than those of pure salts and this is caused by the difficulty of obtaining conveniently saturated solutions and, also, by the influence of soluble salts differing from nitrate. Thus, a *caliche* salt gives a solution with an over-saturation of chloride and with a less quantity of nitrate than the normal. In practice anomalies are sometimes found that seem to contradict technical forecasts.

The operation that is theoretically simple, shows itself to be different practically because the solution of the nitrate is hindered by the

excess of other salts and by the insoluble matter (Fig. 193). However, a method has been selected founded on A PROCESS OF LIXIVIATION AT THE MAXIMUM TEMPERATURE OF BOILING, AT ATMOSPHERIC PRESSURE, AND AFTER LIXIVIATION, THE CRYSTALLIZATION OF THE NITRATE BY COOLING WITH LIQUID AIR.

In practice, saturated solutions of *caliche*, at 90°-100°C. can be obtained that contain 600 gm. of nitrate, 150 of chloride and 60 of sulphate, and which, when cold, deposit theoretically, 250 gm. per litre, and leave a mother liquor containing 400 gm. of nitrate per litre.

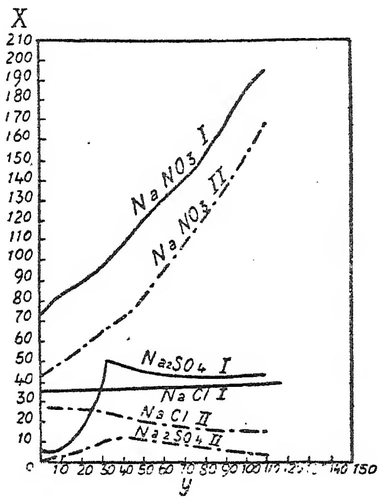


FIG. 193. — Solubility curves of nitrate, chloride and sulphate and of the three together.

x = grams of the salt dissolved.
y = temperature of the solution.

The removal of the chloride and sulphate has been mentioned, in order to make the nitrate more soluble. Such a solution should contain no extraneous salt when concentrated in a closed, high-pressure evaporation apparatus. It has been shown that, at a temperature of 120°C. and a pressure of 1.15 kg. per sq. cm., it is possible to precipitate all the chloride and sulphate from a *caliche*, when the maximum concentration of the nitrate is reached, about 1000 gm. per litre. During the concentration the chlorine and sulphate precipitate owing to deficiency of water and the lowering of their coefficients of solubility, while the nitrate dissolves in the liquid and increases its concentration. This method has been used in the concentration of nitrate of soda of at least 94 %, in order to obtain the almost pure nitrate of soda used for the manufacture of nitric acid.

The pressure and temperature is called critical, and the residual liquid can be almost entirely crystallised by cooling in vacuo, leaving almost no mother liquor.

The phenomenon of the precipitation of salts differing from nitrate and especially of chlorides, occurs only when the liquid is concentrated in the absence of *caliche* (fig. 194). When this is present, and

according to the quantity, the sulphate does not act and continues its precipitation. If among the undissolved salts of the *caliche* the chloride of sodium is in excess over the nitrate, the solution dissolves proportionately more chloride and very little nitrate, at a high temperature.

The solution process must therefore be very accurately controlled in order to obtain a conveniently saturated liquid in a definite time.

The method of working just described is suitable for *caliche* containing a high percentage of nitrate, with an amount below 50 % of soluble material. As these materials change, if the insoluble matter, and especially clay, increases, or if the saline materials and particularly the nitrate diminishes, the profit is not considerable. In order to obtain suitable concentrations a great deal of combustible material and much time are required. The solution does not generally increase its concentration by dissolving the nitrate but by evaporating the dissolving agent. When the available *caliche* had a suitable salt content, as was the case formerly, the yield was about 70 %; at present, with a 15 % material the yield does not exceed 60 %; besides, the amount of combustible required for each ton of nitrate produced has been considerably greater.

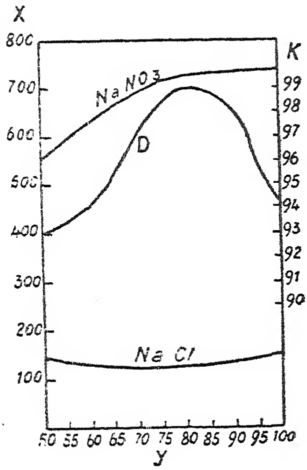


FIG. 194. — Curve showing diminution of solubility of nitrate with respect to chloride in presence of sulphate; more than 80 % when the quantity of chloride in the caliche exceeds 50 %.
D = density; Y = temperature; X = grams per litre; K = density.

It was proposed to concentrate the liquids at a temperature of about 80° C., submitting afterwards the separate lixiviation liquids to concentration in an evaporation apparatus. This method cannot be followed because of the precipitation of large quantities of chloride that obstruct and ruin the evaporation apparatus, besides, the high temperature of steam decomposes the salts of magnesium, separates the iodine and causes electrolytic corrosion.

For concentration at a high temperature, the best evaporation apparatus has been employed, but its use cannot be continued because of the practical impossibility of separating the nitrate from the

common salt, which, precipitating in a liquid having a high nitrate content, still maintains a high percentage of this salt in solution.

It has been proposed therefore to proceed in a different way, that is, to prepare a solution at a lukewarm temperature, having as maximum 50°C. and to crystallize by cooling not in the open airat the surrounding temperature, but at lower temperatures, about 0°C. by artificial cooling. Studying the technique of this process, with the help of the curves formed for pure salts, it is found that, at this temperature solutions are formed, with about 550 gm. of nitrate per litre, that, when cold, deposit about 225 gm., a quantity almost equal to that given by the early method (fig. 195).

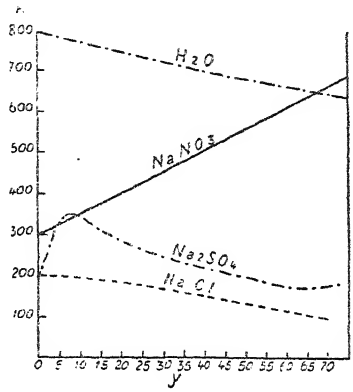


FIG. 195. — Solubility curves of nitrate, chloride and sulphate of soda 0° — 70° C.
x = grams per litre,
y = temperature.

The difficulty met with in using this method that may be called A PROCESS FOR THE RECOVERY OF THE NITRATE FROM CALICHE BY ARTIFICIALLY COOLING THE LIQUIDS RESULTING FROM LIXIVIATION, is even greater than in the former case.

In the first place, the solubility of the salts found in the *caliche* follow only approximately the form of solution curves of pure salts, and the concentrations obtained are not so suitable. Secondly, not all the *caliches* are susceptible of being efficiently lixiviated at the surrounding or tepid temperatures; the solution depends in this case on the saline composition of the *caliche*, excepting the chloride of sodium. Lixiviating a *caliche* at the above temperatures the solution concentrates first in chloride of sodium and nitrate and the sulphate dissolves afterwards. When the solution contains equimolecular proportions of both salts and has reached the concentration of 216 gm. of nitrate per litre, an insoluble compound is formed named *Darapskita* ($NaNO_3,Na_2SO_4.H_2O$), already mentioned in connection with the nitre formation called *caliches de los salares*.

The *Darapskita* already exists in some *caliches* and is formed whenever the proportions of nitrate and sulphate are equimolecular. It is insoluble at 20°C., in a solution equal to or above 216 gm. of

nitrate, and at 45°C. in more than 360 gm.; separates partially with an elevation of temperature and completely at 60°C.

For the lixiviation of the *caliches*, at the surrounding or tepid temperatures, the nitrate present in the raw material must be considered under two forms: combined with the sulphate and as free nitrate that dissolves and increases the concentration of the solution.

On this account the solutions are far from having the necessary concentration for precipitating the nitrate economically, by artificial cooling.

The greater part of the *caliche* deposits, named *caliches de salar*, belonging to a secondary formation, has sulphate and nitrate proportions very near the equimolecular proportions and does not dissolve normally.

It may be considered that those deposits of *caliche* are formed by lixiviation at the surrounding temperature, of different materials situated in other regions and that solutions have concentrated and evaporated forming the *salares* in which is found the nitrate-sulphate, or *Darapskita*.

The difficulty has been overcome by Drs. BURDICK and FREED of the wellknown firm *Guggenheim Bros.* that has undertaken the study of this system.

It has been found that some radical elements or chemical substances take the place of the nitrate molecule in the *Darapskita*, combining with the sulphate of sodium and forming other insoluble compounds. These elements named *estabilizadores* or *estabilizantes* are among others: potassium at a concentration of 16 gm. or more per litre, that forms *Singerite* ($K_2SO_4 \cdot CaSO_4H_2O$).

Magnesium, at a concentration of 21 or more gm. per litre, that forms *Astrakanite* ($Na_2SO_4MgSO_4 \cdot 4H_2O$).

Calcium, that forms the *Glauberite* ($Na_2SO_4 \cdot CaSO_4$), a compound that has the advantage of requiring for its perfect consolidation less sulphate of sodium as the nitrate increases in solution.

The experiments have proved that the solubility of the total nitrate of *caliche* takes place: (i) with the increase of concentration of the consolidating substance, (ii) with the increase of temperature, (iii) with the quality of material used.

These factors, *estabilizantes* or *estabilizadores*, not only make it possible to extract by lixiviation all the nitrate from the *caliche*, but help the precipitation of nitrate by artificial cooling, obtaining a deposit of this substance greater than could be obtained in any other way.

When a liquid saturated at the surrounding temperature with nitrate, chloride and sulphate, is artificially cooled, the solubility of nitrate diminishes as the temperature decreases, while, on the contrary, the solubility of the sulphate increases, reaching the maximum at 7°C. At this temperature three solid phases coexist: nitrate of sodium, *darapskita* and sulphate of sodium ; the change of solubility of the sulphate of sodium from 7°C to 0°C. is very quick so that, cooling at a lower temperature, we obtain a mixture of sulphate and of nitrate. Thanks to the materials the solubility of the sulphate increases, the transition point gets some degrees lower, the cooling temperature can be brought to about 0°C., increasing the yield of the nitrate obtained without damaging the quality.

***

The insoluble materials of the *caliches* are also important in the lixiviation ; they are formed of stones, sand, clay and the salts insoluble in the dissolving liquid, excess of chloride and sulphate of sodium. When the *caliches* contained much nitrate and few insoluble materials and no clay at all, they were porous and could be very well lixiviated, even if put in the tanks in relatively large quantities. At present, when the average amount of nitrate in the *caliche* does not exceed 20 % and the insoluble materials are higher than 50 %, it is very difficult to make the liquid penetrate. At first it was proposed to grind the material more, in order to present a larger surface to the dissolving liquid, but it was found that: (i) this produces sediments or *lodos*, very hard to decant; (ii) the saline, hot dissolving liquid separates more easily the insoluble matter when the *caliche* is ground into small pieces, setting free a greater quantity of light insoluble materials; (iii) in the tanks the hollows occupied by the dissolving liquid diminish, increasing the ratio between the solid matter and the volume of the dissolving liquid ; the small particles produced fill the cavities and form impermeable coverings that must be broken down, to allow the circulation of the liquid in the tanks; agitation by air, steam and mechanical means, increases the sediments or *lodos* and the result is a very homogeneous mass in which it is not possible to separate the dissolving liquid from the used and exhausted matter. When the insoluble materials have a larger surface and a greater ratio of clay is present, the capacity for absorption of the dissolving liquid is increased, to the extent sometimes of 20 % or more of its weight. This

phenomenon limits also the lixiviation and does not allow the formation, with poor *caliches*, of a liquid with a high concentration of nitrate; then the fresh *caliche* treated with a concentrated liquid, obtained by heat, absorbs and increases its content of nitrate instead of setting it free in solution. Each *caliche* requires a special grinding, during which a part of the solid matter is ground into a fine dust that causes sediments and that must be separated in the tanks from the big pieces and from the ash, before lixiviation.

***

The nitrate industry was formerly a domestic industry; iron pots were filled with pieces of caliche from the soil, with a content exceeding 50 %, and boiled with water over stones in order to form a saturated solution. This was decanted and then cooled in a flat trough called a *batea*. The material treated in such a way gave 25 % or more of nitrate and the output was not great.

The real industry began in 1870 by the testing of various apparatus to find a process for lixiviation. But the problem was solved when Dr. S. HUMBERSTONE introduced in 1878, the lixiviation process of SHANKS, employed for crude soda in the LEBLANC process, adapting the tanks to hot treatment and raising them so that they could be discharged from the bottom. As is well known, the lixiviation process of SHANKS takes place with an excess over the solid matter, of the liquid that passes from one tank to another (fig. 196), which is always brought into

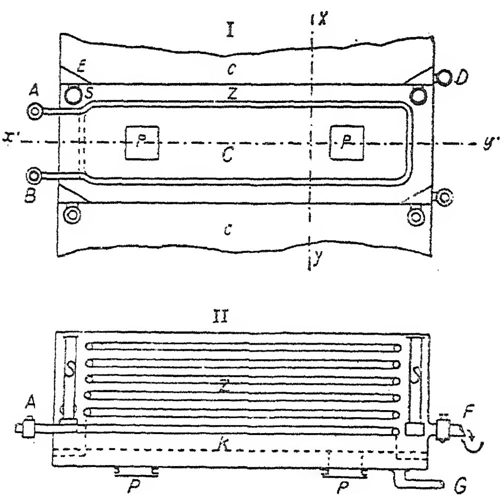


FIG. 196. — Section and plan of a lixiviating tank, or " cachuco ".

A = outlet for steam, B = inlet for steam, C cachuco D = outlet for solution, E = refill inlet of " chullador ", F = discharge deposit, G = discharge of the K = bottom plates, S = siphons, Z = condenser, *c* = cachuco, *p* = doors.

contact with fresh solid matter and thus increases its concentration. Elevating, at the same time, the temperature of the liquid, it becomes saturated with nitrate at the final temperature of lixiviation, viz., the boiling temperature of the solution at atmospheric pressure (1000 m. altitude). The movement of liquids is due to gravity, a higher column of a weak liquid takes the place of a lower one of concentrated liquid. The treatment is carried out in

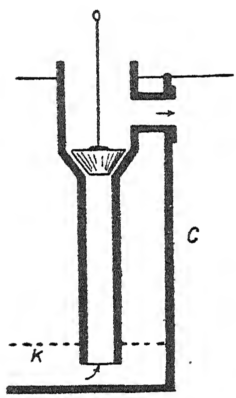


FIG. 197. — Old type of Shank's siphon.

C = "cachuco".

K = bottom plates.

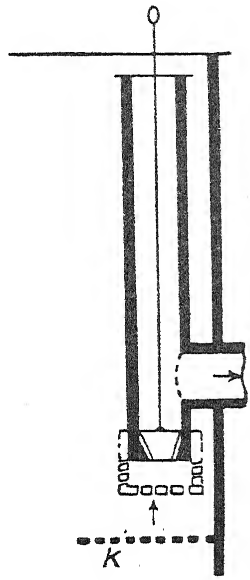


FIG. 198. —Type of siphon now in use.

C = "cachuco".

K = bottom plates.

rectangular vessels of equal height and width, and a length six times these dimensions, and containing heating-coils and a perforated double bottom about ten cm. from the base. These containers, or *cachuchos*, stand 2 m. from the ground, over supports, and have holes in the bottom for the extraction of the exhausted materials, and sundry valves and connections.

Six, eight or more, are put side by side, connected by a siphon (figs. 197-198) called the *traspaso*; the long branch put in the *cachucho* that supplies, and the short one in the container that receives, the liquid. The working of this system is too well known to need any

description. It is thus possible to effect a number of transfers of the liquid, corresponding to a washing of the container that receives the dissolving liquid (*cachucho de cola*). Owing to the passage through the other containers the liquid comes from the head *cachucho* concentrated and at a suitable temperature.

The SHANKS process of lixiviation is a very rigid one that allows only a definite quantity of dissolving liquid, while the washings and the mother liquor must be lixiviated. The only fresh solvent available is the water evaporated during lixiviation and crystallization, that which is taken by the other products and residues and what runs over. The SHANKS process regulates methodically the concentration of liquid in the containers. With a concentrated head liquid the final liquids acquire a high concentration ; it is not possible to go on washing indefinitely, owing to the volume of liquid which increases progressively. For a perfect washing, a set of containers is necessary twice as numerous as that now in use. This is not economic practically, because the expense increases the working costs; also, on account of the hydraulic passage system it would cause the mixing of a concentrated with a dilute liquid, and would thus make useless the work of solution ; it is intermittent therefore, for increasing the temperature, the siphon must be closed for leaving the liquid in contact with the *caliche*, the *cachucho* having only steam during several hours.

The LEBLANC lixiviation method adopted, being at the surrounding temperature and having neither mother liquor nor washing water, had very little influence in the treatment of *caliches*. When it was adopted, *caliches* were porous, soluble, without sediments and with a high yield, the nitrate fetched a high price and combustibles and labour were cheap ; now, the *caliches* are poor, every factor is unfavourable and the profits decrease slowly but surely.

An improvement has been tried by separating the big pieces from the small after grinding, lixiviating only the former and treating the latter differently; large sums of money have been spent with very small economic results. A reduction has been brought about in the temperature and final concentration of the liquid, which is concentrated separately in an evaporation apparatus, but the result is unsatisfactory.

As was mentioned above, an apparatus has not so far been found, capable of economically concentrating the dilute solutions (*flacos*).

All these improvements serve to increase the yield of some parts

PLATE LXXII.

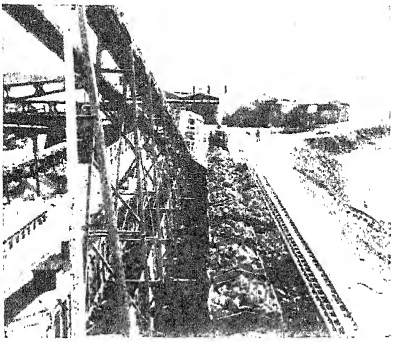


FIG. 199. — *Caliche* raised and discharged by a mechanical elevator.

FIG. 200. — Mechanical elevator.

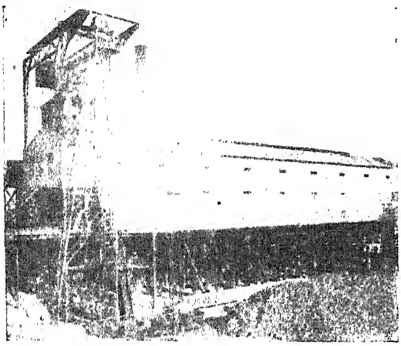


FIG. 201. — Another type of elevator.

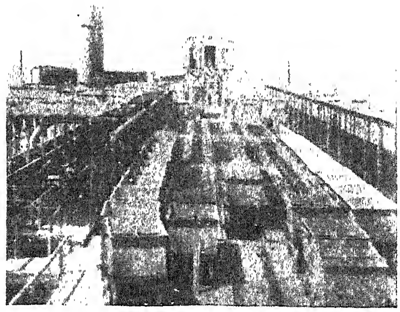


FIG. 202. — View from above of the platform used for placing the *cachuchos* on waggons.

FIG. 203. — View of *cachuchos* protected by wooden beams, and loaded on carts.

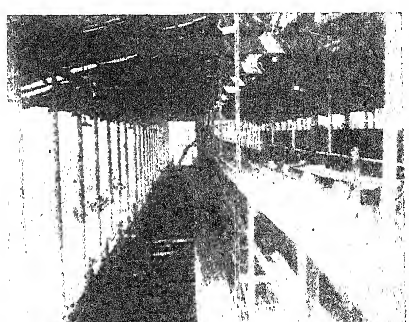


FIG. 204. — Load of *cachuchos* with endless transporter; on the left the heating coils.

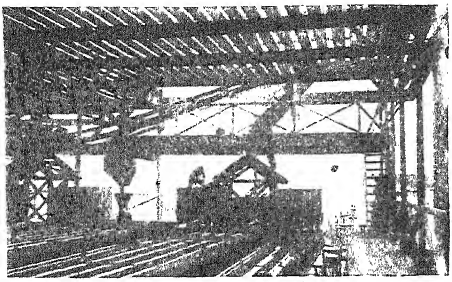


FIG. 205. — Load of *cachuchos* with transporter and carts, and sifting out of small pieces.

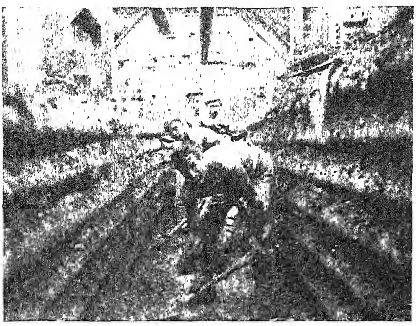


FIG. 207. — The interior of a discharged *cachucho*.

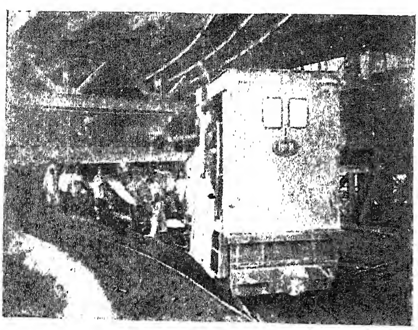


FIG. 208. — The lower part of the *cachucho* when the residues are put into waggons.

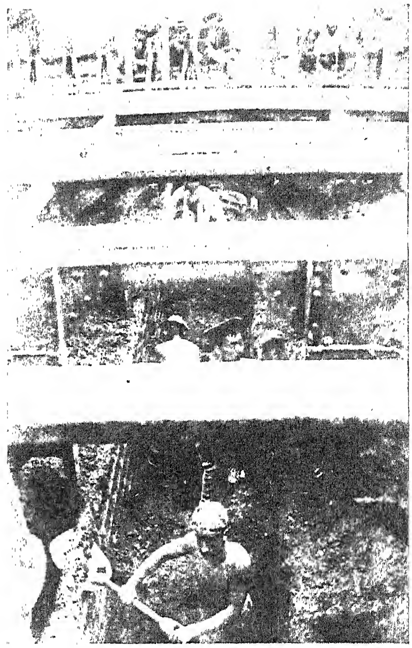


FIG. 206. — The upper part of a discharged *cachucho*.

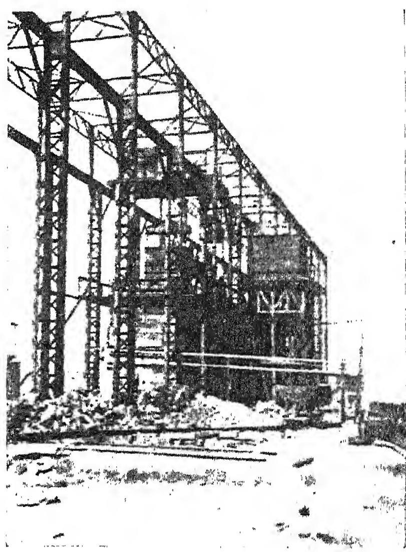


FIG. 210. — General distribution of the fixed and moveable *cachuchos* on the swing-bridge.

only of the total mass of *caliche*, and complicate subsequent processes, and require expensive installations, very difficult to maintain in the nitrate Pampas.

The *caliche* having been ground, and the dust and small fragments separated, the larger pieces are treated by the SHANKS lixiviation process (fig. 199, Plate LXXII).

As a rule the material has to be raised about 6 m. (figs. 200-201, Plate LXXII), to the level of the *cachuchos*, where it is distributed to the containers (fig. 202, Plate LXXII). The transport and distribution is carried out by means of various types of endless-band transporters, inclined planes, lifts, etc. (figs. 203-204, Plate LXXII).

Experience has proved that the methods of transport and the arrangement of the material in the containers are important in obtaining a good lixiviation, but sufficient attention has not been given to this fact. The material is thrown generally in the tank from the top, in order that it may fall on the perforated bottom; in this way the pieces roll over the heap formed on the bottom and the smaller materials separate from the larger, and assist movement of the liquid during lixiviation. Some *oficinas salitreras* put on the bottom of the container a thick and homogenous filter covering, and place over it the solid material, using automatic distributers that fill in the *caliche* evenly without hollows.

A certain quantity of concentrated solution having been taken from the head container the final container is washed out by intercirculation and is emptied and drained, and the exhausted material taken away (fig. 206, Plate LXXIII).

The removal of the residues (figs. 207-208, Plate LXXIII) is carried out at a temperature of 40° C. by special workmen and entails heavy labour. The residues taken from the lower part of the *cachucho* are collected in waggons and thrown on large heaps at some distance from the factory. It is not likely that mechanical means will be used for carrying these residues, because of the 25 % or more of water that remains in them (fig. 209).

A system of lixiviation is now being tried in which instead of having the liquid pass over the solid matter, this has been introduced into containers full of solution (fig. 210, Plate LXXIII, 211, 212, Plate LXXIV). A movable tank is employed, through two sides of which pass perforated tubes; these tanks are conveyed to the lixiviation tanks by a swing-bridge. The exper-

iments so far made prove that the load is distributed more equally by the use of finely ground material, and no difficulty is experienced by the sediment blocking the internal circulation: lixiviation requires less time and the charging and discharging take place more quickly and cost less than with the SHANKS system. In the near future the SHANKS *cachuchos* may be transformed to this new type with great advantage in yield, combustibles and time.

* * *

Industrial experiments of another process for extracting nitrate from *caliche* have been made, which were mentioned when alluding to the solubility of the *caliche* salts. The lixiviation of the material is done at a low temperature, lower than 50° C. and the nitrate is precipitated from the solutions by means of reduction of the temperature to about 5° C., brought about by the aid of a freezing liquid. The mother liquor contains a relatively small quantity of nitrate.

This process has given such interesting results that the firm of GUGGENHEIM Bros. proprietors of the patent, has built perhaps the greatest installation of the industry, in order to reduce more than two thousand tons of *caliche* per day.

This process is a continuous and cyclical one; a tepid solution is obtained saturated with nitrate that needs no intermediate treatment, the crystallization is continuous and rapid in mechanical apparatus; the lixiviation work does not

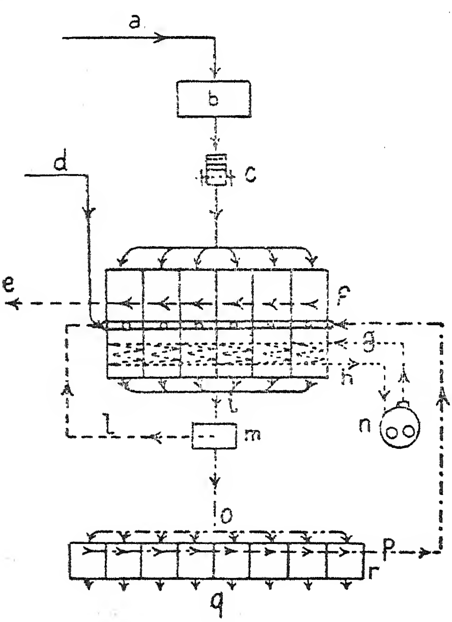


FIG. 209. — Arrangement of the Shank's process.

a = caliche, *b* = inclined plane, *c* = chancadores *d* = water, *e* = poor material, *f* = cachucos, *g* — steam, *h* = outlet, *l* = good material, *m* = chulladores, *n* = heater, *o* = saturated solution, *p* = water *q* = containers, *r* = nitrate bateas.

require any special combustible, the waste heat from the power installation being sufficient for this purpose (internal combustion engines and freezing liquid pressers). The experiments have been made with *caliches* containing only 101-21 % of nitrate and show a notable improvement in total costs. The process must certainly not be put aside as it gives a yield of about 96 %, can treat *caliches* of a low grade and diminishes the cost of extraction, having no need of the selction work required by the present system. As will be seen later, the method of using combustibles has made noticeable progress.

***

The solutions prepared in the *caliche* lixiviation, especially by the SHANKS process at a high temperature, cannot be immediately crystallized, but must be submitted to an intermediate operation known as *chulla*. This unites two different operations: the sediment, by the action of gravity on the insoluble materials in the liquid, precipitates fine sand, clay, and the residues of the solution. The solutions coming from the *cachuchos* have generally a super-saturation of chloride or of nitrate. In order to obtain their stabilisation the temperature of some grades must be lowered until the dissolved nitrate saturates the solution, while the chloride of sodium precipitates. We thus obtain a solution in which the proportions of water, chloride and nitrate have the same relation as the saturated solutions obtained with pure salts.

The *chulla* is carried out in tanks with an inclined bottom (fig. 213), and the liquid is removed by means of a siphon. The *chulla* lasts from 15 to 30 minutes, the time in which the liquid lowers, by radiation, tis temperature and the precipitated salts deposit with the insoluble matter. Abnormal *chullas* take place however when among the insoluble materials collodial clay exists, that require many hours to form a deposit and must first

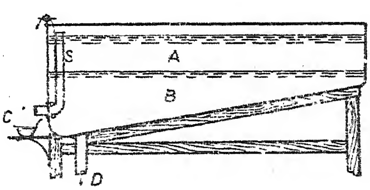


FIG. 213. — Chullador.

A = clear solution,
B = non-clarified solution,
C = channel to bateas,
D = cleaning outlet,
S = siphon.

be flocculated. The *agrumación* or *floculación de las borras* has so far been made by physical methods, substances that coagulate by heat make a film and drag down the residues; only a few experiments on chemical flocculation have been tried. The problem of the residues must certainly be carefully examined.

***

The clarified and stabilised liquid is passed for crystallizatiion into large containers (figs. 213) called *bateas*, with the bottom inclined towards one side, and situated at a certain height. The hot liquid cools on contact with the air and the first crystals form on the sides of the *bateas* and over the liquid surface, hindering thus the passage of the heat and delaying the crystalization. It is necessary to detach the crystals and immerse in the liquid those formed on the uncovered surface, and that requires great care and much labour. This system loses all the latent and thermometric heat of the solution, about 7 % of the total heat used in the elaboration (figs. 216-217, Plate LXXIV; 218-220, Plate LXXV).

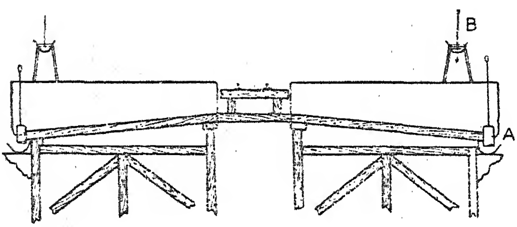


FIG. 214. — Container,

A = mother liquor,
B = liquid from the chulladors.

The experiments of rapid crystallization with heat recovery have not so far given good results, chiefly because the operations are not continuous and we cannot always profit by the recovered heat.

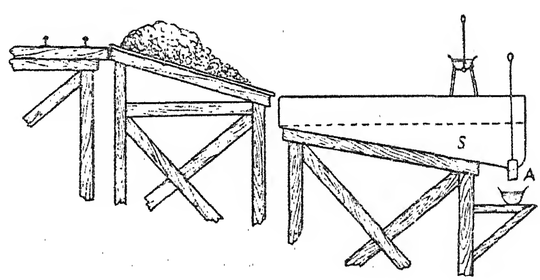


FIG. 215 = Bateas with sloping platform.

S = nitrate,
A = mother liquor.

The liquid concentrated in nitrate at a pressure higher than the ordinary, having a boiling point higher than the normal, contains

PLATE LXXIV.

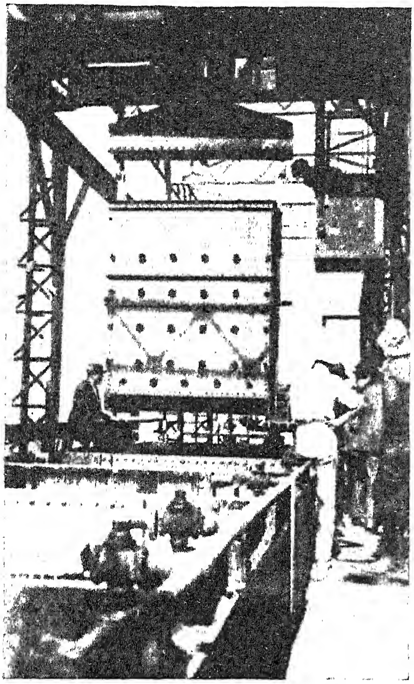


FIG. 211. — The moveable perforated container full of *caliche* is introduced into the *cachucho*.

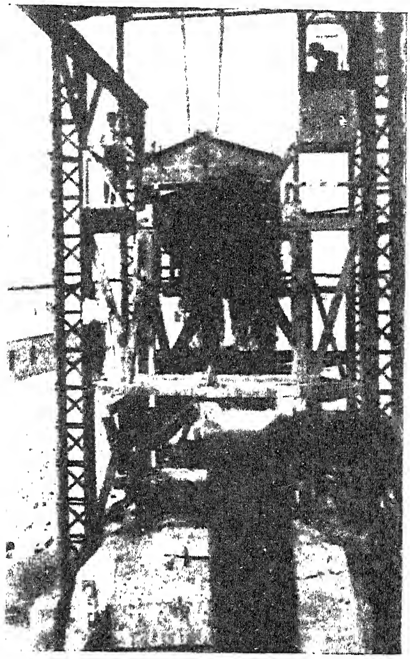
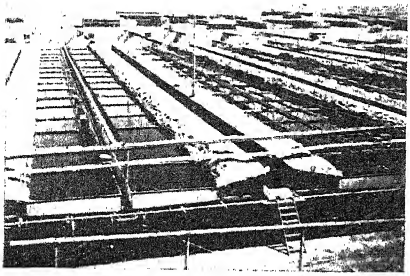
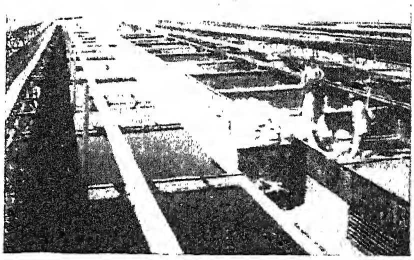


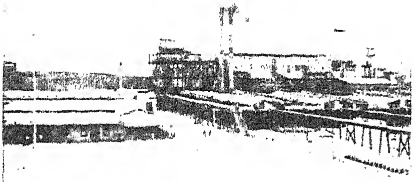
FIG. 212. — Discharge of the moveable container.

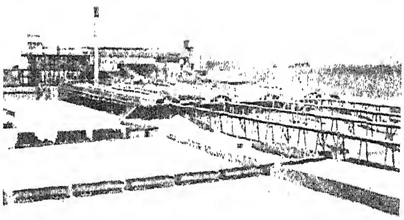




FIGS. 216-217. — *Bateas*.

PLATE LXXV.





FIGS. 218-219. — *Bateas.*

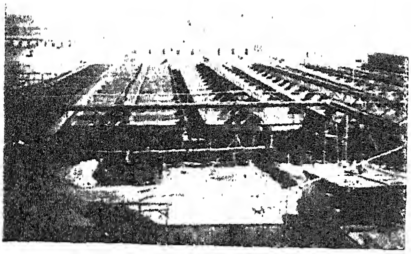


FIG. 220. — *Bateas.*

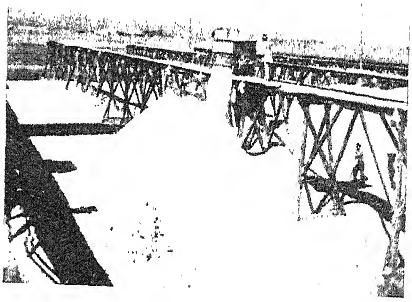


FIG. 221. — Bridge and accumulation of nitrate.

PLATE LXXVI.

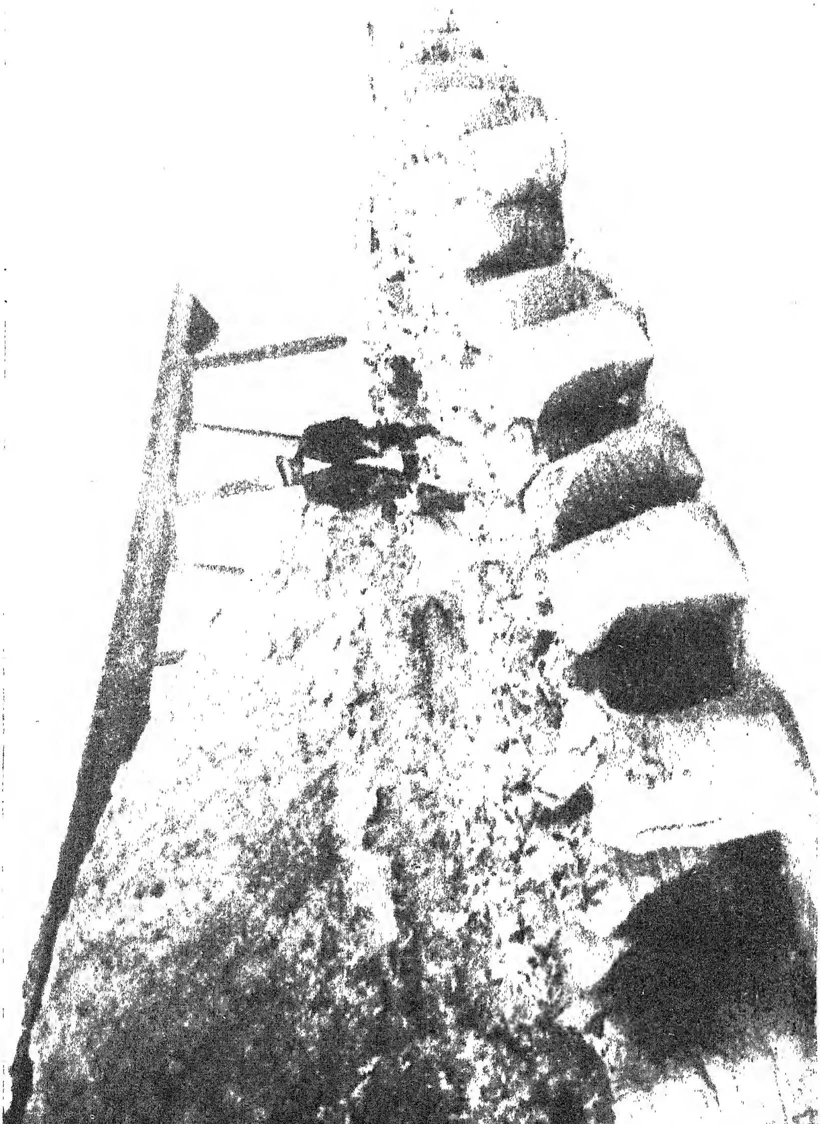


FIG. 222. — Bagging the nitrate.

pratically no chloride of sodium and can be crystallized by an almost complete evaporation of the dissolving liquid. The experiments demonstrate the great mechanical difficulties. When the crystallization is completed — remaining 100 or more hours in the *bateas* — these are dried and the mass of solid matter is drained by heaping it in the highest part of the *batea*, and drying afterwards in the *canchas* (enclosures).

The nitrate that maintains a relatively high moisture in the form of mother liquor, of about 5 %, is dried by spreading in the open air and in the sunshine (fig. 221, Plate LXXV) in semi-permable *canchas*. A part of the water is absorbed by the ground, another part evaporates and, after some days only about 2 % moisture remains. The nitrate is then put into sacks; these are marked and are ready for export (fig. 222, Plate LXXVI). The liquids already are lixiviated and sometimes treated especially for extracting the contained iodine.

The mother liquor, saturated with nitrate at the ordinary temperature, could certainly be treated in order to crystallize a greater quantity of nitrate.

To obtain another deposit of nitrate it would be sufficient to cool the water to about 0° C. During the war the mother liquor was cooled, crystallizing out a mixture of sodium nitrate with 30 % or more of potassium nitrate and the product was sold to the U. S. of North America as fertiliser.

***

The manufacture of nitrate by extraction from *caliche* requires the use of combustibles. It has been throught that the climate of the Pampas might be employed for the various nitrate processes with the least possible quantity of combustible. In the Pampas the average daily temperature is high and during the night below freezing point. The liquid evaporation is made easy by the height, the dryness of the atmosphere and the constant winds. It seems very simple to dissolve the *caliche* in water, at the ordinary temperature, use the sun's heat to compensate for the heat lost by dissolving the sodium salts in water, to evaporate the liquid, saturated with nitrate at the ordinary temperature, in the open air, and to collect the salts that precipitate during the evaporation of the lixiviation liquid which may contain a maximum of 50 % of nitrate. We could

thus obtain a mixture of salts with a concentration in nitrate of the low-grade *caliches* without having used any combustible.

The experiments show that it is not possible to compensate rapidly, by sun heat, the negative heat of solution of a salt that requires an enormous quantity of liquid for obtaining a balance in the temperature. They demonstrate also that the evaporation of water in the open air is more expensive, for the value of the lost water, than the cost of combustible. Besides, the lixiviation installation would be very large and the surface required for sun evaporation would occupy an impossible area. The combustible is, therefore, essential and is used for the production of the mechanical energy required in the preparation of the *caliche* and serves for transporting solid and liquid elements, for lighting the laboratories, etc., and for the production of the heat necessary to dissolve salts and separate nitrate from other soluble salts.

The mechanical energy consumed in the installation represents only a fraction of the combustible employed, about 6 %, but as more machinery is employed for taking the place of human labour and for grinding more finely the *caliche*, the consumption increases and may reach 10 %.

With the pure salts that are found in the *caliche*, mixed with 50 % of nitrate, only 200 000 calories per ton of crystallized nitrate should be needed ; for obtaining the concentrated nitrate at 100° C. the other salts are dissolved and crystallized, supposing that losses have taken place in the lixiviation process.

In practice, the necessary and occasional losses exceed the heat energy used ; these losses are caused :

(*a*) by radiation, by convection and conduction of the heat in the apparatus tubes, valves, etc ;

(*b*) by the hot materials removed from the lixiviation system, residues and sediments ;

(*c*) by the evaporation of water during lixiviation ;

(*d*) losses of heat corresponding to an elevation of temperature without dissolving a greater quantity of nitrate.

The above mentioned losses increase : with the greater difference between the final lixiviation temperature and the surrounding one ; with the percentage of insoluble materials removed during the lixiviation process ; with the time taken by the operations ; with absence of control in the lixiviation process ; with the defects of heat insulation in the installation.

Further, at present very hot solutions are extracted that crystallize by cooling in the open air, without recovering the latent heat, and form another source of loss of heat. The losses of calories, in the present system of elaboration at a high temperature, are on the average the following:

For each 100 *calories of combustible*:

(*a*)	Losses	in the boiler	40 %
(*b*)	"	by radiation, convection and conduction .	13 %
(*c*)	"	by removal of hot residues	5 %
(*d*)	"	by water evaporation and reheating of the solution without any greater production of nitrate	27 %
			85 %

In the concentration of the liquid we may take advantage of 15 % of the combustible heat, raising the temperature of the solid and liquid elements and neutralising the negative heat of solution of the dissolved nitrate. The thermometric heat corresponds to 8 %, that is lost during the *chulla* and crystallization by cooling in the open air.

It is evident that many losses may be reduced to a considerable extent: by modern installations of boilers; by more careful heat insulation; by a final lixiviation temperature lower than the boiling temperature of the solution; by recovering the heat that is now lost and may practically be recovered by interchanges (hot liquids that come from the lixiviation with cold ones that go into it). The calorific yield of the process can perhaps be increased by 25 %.

It is clear that, requiring heat and mechanical energy in the nitrate elaboration, we can obtain, owing to a combined system of production of mechanical energy and heat, a diminution in the quantity of combustible, using only one installation instead of two as at present in most of the laboratories.

For the hot elaboration methods mentioned named viz., the final temperature of which is near boiling point at the normal pressure of the saturated solution, we can draw up the following scheme of consumption for 100 thermal units of combustible.

Combustible

100

↓

High pressure boilers with recoverers, induction-tubes, reheaters, etc.

↓

35 % (consumption)

↓

High pressure motors for producing mechanical energy.

↓

15 % (consumption).

↓

Lixiviation and evaporation system

↓

50 % (available)

About 10 % of the available 50 % could be recovered.

The following is the scheme for the process of tepid lixiviation, up to 60ª C. with internal combustion motors and the use of the lost heat:

Combustible

100

↓

Internal combustion motor

Heat of the recovered combustion gases.

Electric energy	Calorific energy
↓	↓
31 %	63 %
Mechanical energy employed impossible to recover	Recovery of the ammonia compresser heat . . . . 10 %
↓	↓
20 %	Available calorific energy . . . . 73 %

Heat from the cylinder of the refrigerator.

At least 40 . of the available energy can be recovered.

As in this case the final temperature of the system is lower than in the hot system (at least 40 %), we can use all the lost heat, with a greater yield than in the former case although with a lower potential. As we have seen, the tepid process, allows a much better use of combustibles.

***

The Chilean nitrate of sodium is sold with a guarantee of purity of 95 or 96 % of sodium nitrate, determined by the differential method, deducting from 100 % the impurities: moisture, chlorine expressed as chloride, sulphates and borates, etc., expressed as sodium sulphate.

The *Asociación de Productores de Salitre* fixes the prices according to the market and the consumption.

The cost of production of Chilean nitrate, is very variable, depending upon many factors that are influenced by numerous and various causes. Firstly, the condition of the world market for nitrogen; when the consumption diminishes, the price decreases; the international exchanges, the weather and the crops have also an influence. The trade restriction causes a fall in the production (this is now, in respect to its total capacity, about 60 %), the fall in production causes a fall in the price of manual labour. The exchange of the pounds sterling in respect to Chilean money has its influence also; nitrate being sold in English money, and internal consumption and manual labour being paid in Chilean paper-money, a greater value of the pound gives the producer a larger profit.

The total average cost of the whole production may be classified under various heads; fifteen years ago they could be distributed thus:

Fiscal taxes	45 %
Materials	7 %
Carriage and transport	10 %
Manual labour	20 %
Combustibles	12 %
General expenses	3 %
Interest, sinking-fund, etc.	3 %

The same factors have, nowadays, a different value and can be thus distributed:

Fiscal taxes	38 %
Materials	9 %
Carriage and transport	11 %
Manual labour	22 %
Combustible	15 %
General expenses	3 %
Interest, sinking-fund, etc.	2 %

According to North-American experts who, at the order of their Government studied in Chile the cost of nitrate, the average cost per ton is:

Primary cost	. . . .	$ 12.96
Secondary "	. . . .	$ 16.72
	Total cost . . .	$ 29.68

The primary cost is what is called in the industry *coste en cancha* and includes: cost of extraction, carriage, elaboration, administration, sinking-fund and interest and depreciation of machinery and of the land. The costs vary considerably for each establishment. The secondary costs include: bagging the nitrate, carriage to the port, the cartage and embarking at the port, taxes and commissions. This is an almost invariable factor for every establishment. The primary cost is calculated by the number of tons of *caliche* brought into the installation and depends chiefly upon two factors: the nitrate content of the *caliche* and the extraction yield.

The North-American experts stated: that the price they fixed is an average price that can be maintained for several years, that nitrate selling at the present price of $41.80 per ton, the industry receives a guaranteed profit, but, if the price diminishes to $36 the Chilean industry will no longer be able to extract sodium nitrate profitably.

This pessimistic conclusion seems rather exaggerated because the industry can reduce the cost by improving the present yield, modernising the installations, adapting methods that are new, but have been so far sufficiently proved, paying less in taxes, organising the service of purchase, of sale, of carriage, all of which are possible and are already being put in hand.

The most important item is, no doubt, the substitution of the present SHANKS elaboration system by others that are more efficient; there are methods that have been sufficiently tested and factories are built for using them in practice. Later on, the above changes are sure to effect a noticeable transformation in the methods of extraction of the Chilean nitrate and a reduction of its cost.

Besides, the competition of the Chilean nitrate and similar synthetic, or natural substances, is of little consequence because of the always increasing need to supply human food in larger quantity and at a lower price, in order to avoid the race perishing. The nitrogen

requirement will therefore, probably increase at a greater ratio than the total nitrogen production.

To fix atmospheric nitrogen, by any one of the processes so far known, we need a quantity of energy much greater than the energy required for *caliche* extraction. The cost of this energy, whatever its origin (water, coal, petroleum), is inclined to rise and to be absorbed by other industries that can give for it a higher price. The most industrial countries, those in which the industry of nitrogen fixation is now beginning to develop, are, undoubtedly, those that will be obliged to turn to more profitable industries.

BELISARIO DIAZ OSSA,
Professor of Chemistry of the University of Chile, General Secretary to the Scientific and Industrial Nitrate Institute, Santiago.

THE DOMESTIC ANIMALS OF ROUMANIA.

Stock breeding was in a very flourishing condition in Roumania in the first half of the last century, when Roumania exported, mostly to the countries of Central Europe, cattle and horses for army service. In consequence however of the protective duties imposed by Austria-Hungary and Germany, this exportation ceased, stock breeding fell into disuse and the breeds degenerated. The number of domestic animals however continued to increase, though slowly, until the world war.

After the war, the area of Roumania was increased by the provinces which until then had been under the Austro-Hungarian dominion, and where, consequently, the protectionist régime had been in force, and breeding was evidently thus in a more prosperous condition than in the provinces of the Former Kingdom of Roumania.

The war caused great scarcity of livestock, especially in the Former Kingdom, where the number of animals has not yet reached the pre-war figure. It is however increasing rapidly. The number of domestic animals in the whole of Roumania in 1925 is as follows:

Horses	1,828,129
Oxen	5,553,871
Buffaloes	185,280
Sheep	12,480,967
Goats	584,747
Swine	2,924,603
Asses and mules	14,359

BREEDS

The principal breeds of animals in Roumania together with their characteristics are given below:

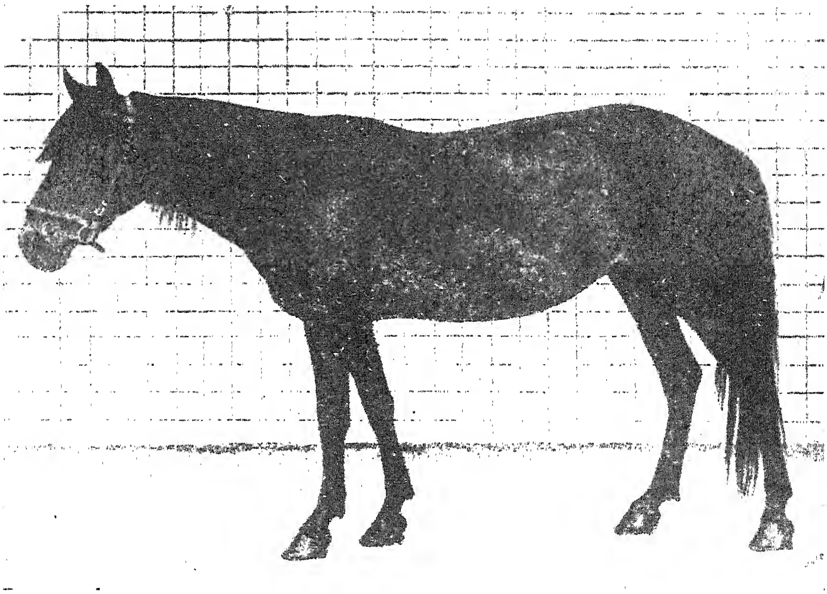


FIG. 223. — Mare, Roumanian breed, Moldavian variety (after Filip).

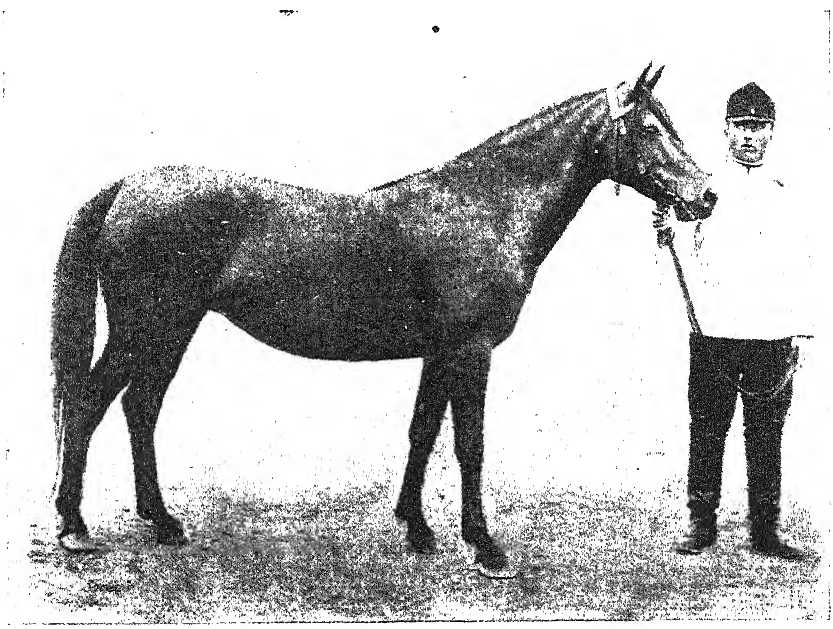


FIG. 224. — Mare, mountain breed (Filip).

PLATE LXXVIII.

FIG. 225.—Nonius XXVII, Stallion.

PLATE LXXIX.

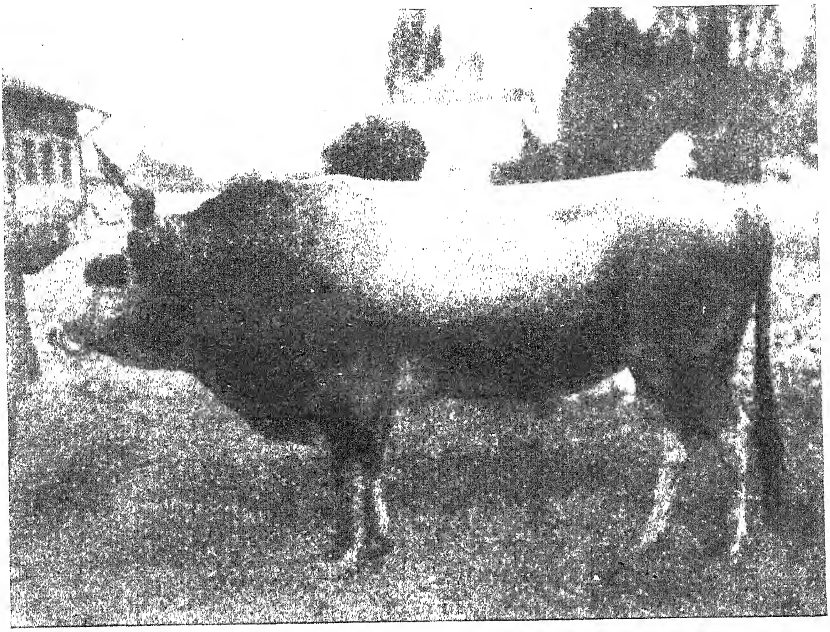


FIG. 226. — Bull, Steppe breed, Moldavian variety.

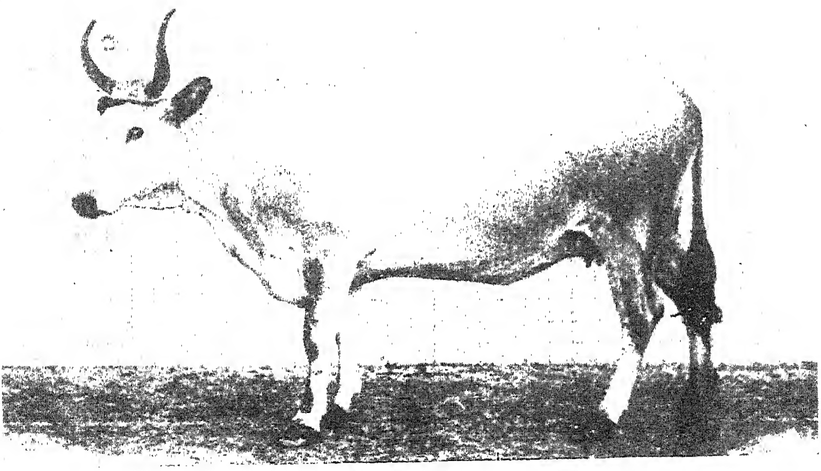


FIG. 227. — Cow, Steppe breed. Moldavian variety (Filip).

PLATE LXXX.

FIG. 228. — Herd of cows, Steppe breed, Moldavian variety (Filip).

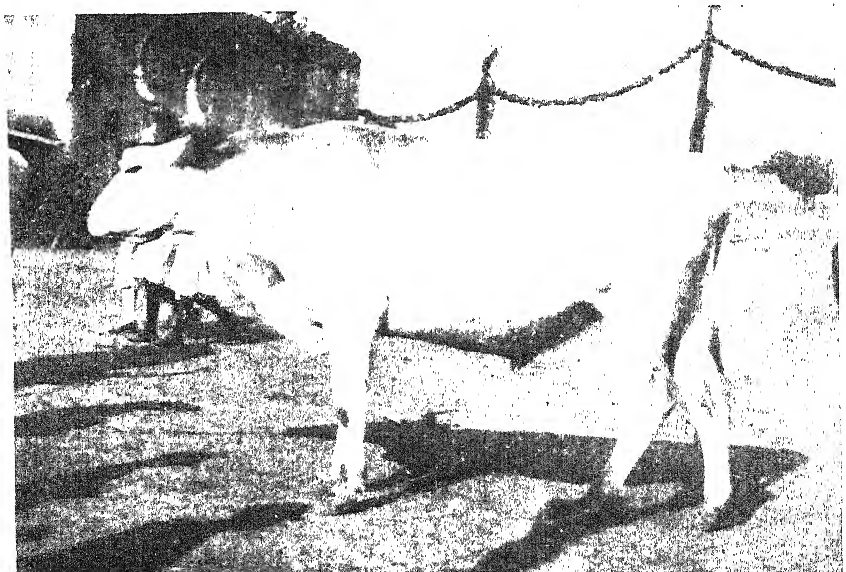


FIG. 229. — Ox, Steppe breed.

PLATE LXXXI.

FIG. 239. — Cow, Roumanian Mountain breed (after Filip).

PLATE LXXXII.

PLATE LXXXIII.

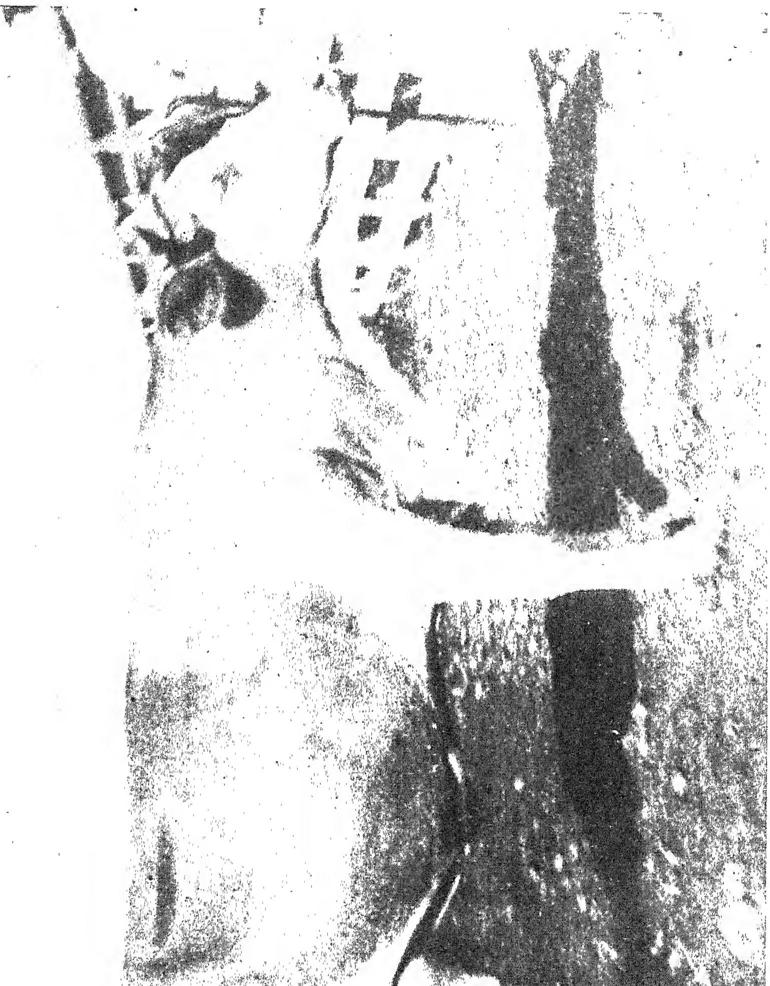


FIG. 232. — Simmenthal milch type, bred in Roumania.

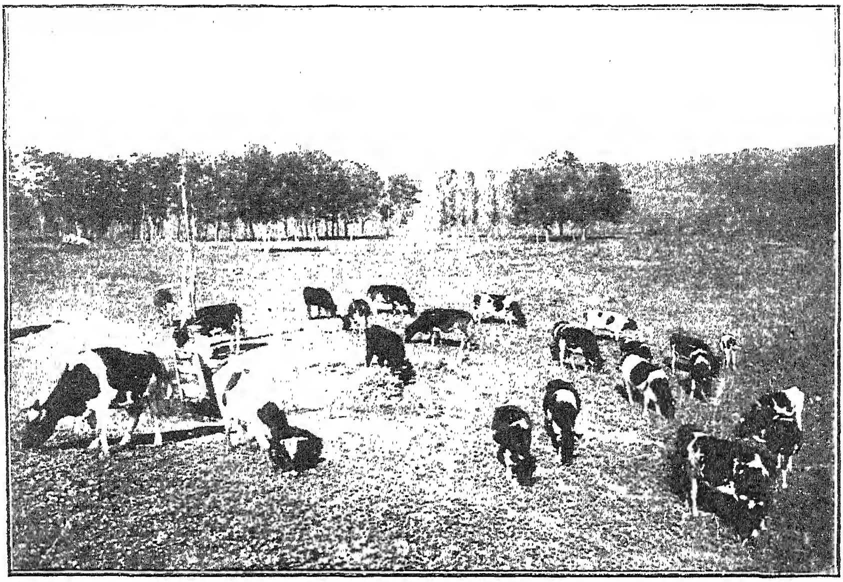


FIG. 233. — Communal herd of cattle, Simmenthal breed.

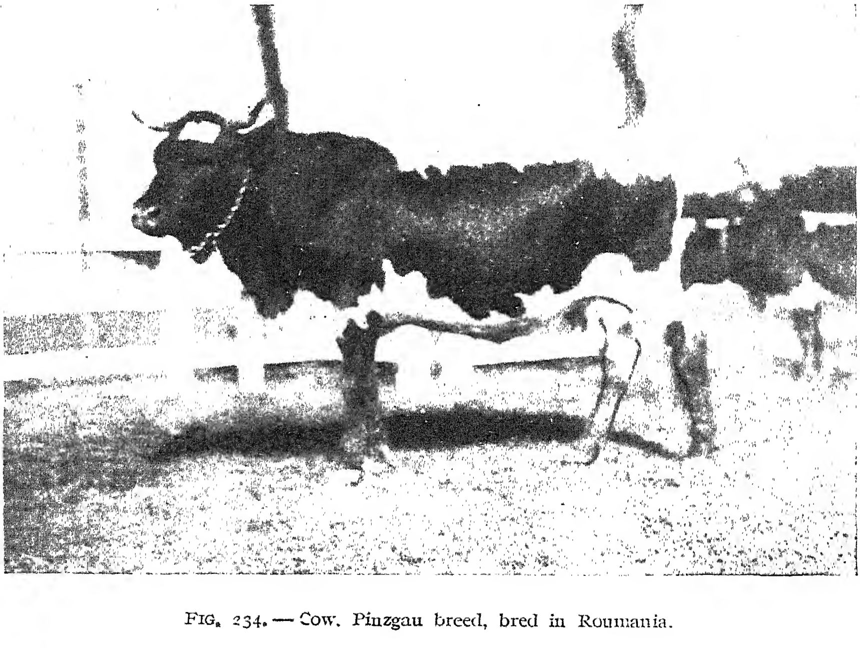


FIG. 234. — Cow, Pinzgau breed, bred in Roumania.

I. Breeds of Horses.

A. *Autochthonous Breeds*. Roumania possesses first an indigenous, high spirited breed of small size, which includes the following varieties: (1) the *Moldavian horse* (fig. 223 Plate LXXVII), formerly of high reputation, to-day very defective owing to the decline in breeding. This horse has the characteristics of the Arab; its height to the withers is 1.40-1.45 m. (the best specimens reach 1.50 and the worst less than 1.40 m.); the head is square, the ears small, the nostrils expanded, the withers not too prominent but evident, the back generally long, the croup short and low, the tail well attached, the chest narrow, the limbs slender and well proportioned, the fetlocks slender, the hoof hard, the set of the leg generally incorrect (cow elbows), the skin fine, and the weight from 300-400 kg. It is a slow animal, requires little care and possesses great endurance. (2) The *Dobrugian horse* resembles the foregoing, but is rather smaller, being 1.30-1.35 m. in height. (3) The *Transylvanian horse*, taller (1.50-1.55 m.), weight 400-450 kg., of less noble form, is also found in the Wallachian plain in the Department of Ialomitza, whither it has been imported by the Transylvanian immigrants under the name of *Ialomitza horse*, now very rare. (4) The *mountain horse* (fig. 224, Plate LXXVII), small and thickset, height 1,25-1.30 m., weight 300-320 kg., bred and worked by the inhabitants of the mountainous regions of the Carpathians.

There is still another autochthonous mountain breed in Roumania, the *Hutzul*, found in Bucovina, and in Poland also and Eastern Galicia. It is small, 1.31 m. to the withers and 350 kg. in weight; it is a mountain breed, of compact body with bushy tail, mane and forelock; the fetlock is 16.6 cm., the hoofs short, the chest broad and low.

The German farmers of South Bessarabia breed a horse known as the *German horse*, of large size (1.51-1.65 to the withers), slow, with a thick coat, large head, low withers, long back (up to 10 cm. longer than the height at the withers), croup short and oblique, limbs weak and defective, fetlocks slender, hair long; this horse is the result of various crossings with Ardennese and Orloffs. It shows great variability of character, and is used for farm work.

B. The *breeds imported* and reared in Roumania are: the *thoroughbred English horse*, for the breeding of which there are about 20 pri-

vate stud-farms in the Country and two large racecourses at Bucharest; the *thoroughbred Arab*, which is found only on the State stud-farms, the *halfbred Arab and English* the *Lipitzan breed*, the *Nonius Anglo-Norman* variety, (fig. 225, Plate LXXVIII), comprising the large and small Nonius, the *English-Arab* "*Gidran*", the Orloff breeds and the draught breeds: the *Percheronne*, especially in some hilly districts of Moldavia, the *Ardennese*, especially in Bessarabia, and the Pintzgau, especially in Banat, where the lighter Mura variety is found.

II. Breeds of Cattle

A. *The autochthonous breeds*, of which Roumania possesses the *Steppe breed*, an excellent worker largely used for ploughing, and the *mountain breed*.

The following are the varieties of the *Steppe* breed: (1) the *Moldavian ox*, *Bos taurus primogenius dacicus* Werner (figs. 226, 227, Plate LXXIX; 228, 229, Plate LXXX), with horns averaging 35 cm., usually in the form of a lyre, silver-white or ash-coloured coat, the neck deeper in the bull, height to the withers 1.30-1.41 m., the back defective, croup often higher than the withers, breast narrow and low, hindquarters but little developed, high on the feet and of a slow type, the Moldavian ox is very hardy and of lively temper, with a quick step and great drawing strength; the calf at birth weighs 20-25 kg. and the adult as much as 600-650 kg.; when fattened it may reach 900-1000 kg.

The cows give 1000-1500 litres of milk per year with an average percentage of 4-5 % of butter. (2) The *Boucsan ox*, greatly resembles the Moldavian ox, but is less tall (1.30-1.35 m.), broader, more compact, more thickset, with smaller horns and a deep ash-coloured coat. (3) The *Ialomitza ox*, bred in the south of the Country, possesses all the characters of the Moldavian ox, but is narrower and longer and has larger horns; it resembles somewhat the Transylvanian ox, to which it is related owing to the immigration of Transylvanians in the district of Ialomitza. (4) The *Transylvanian ox* is characterised by the enormous length of its horns and by a greater height than the other varieties of the Steppe breed.

The *mountain breed* (fig. 230, Plate LXXXI) is a small animal averaging 1.17 m. in height, weight 330-350 kg., with short semicircular horns, a fine skin and glossy short hair; the coat is generally

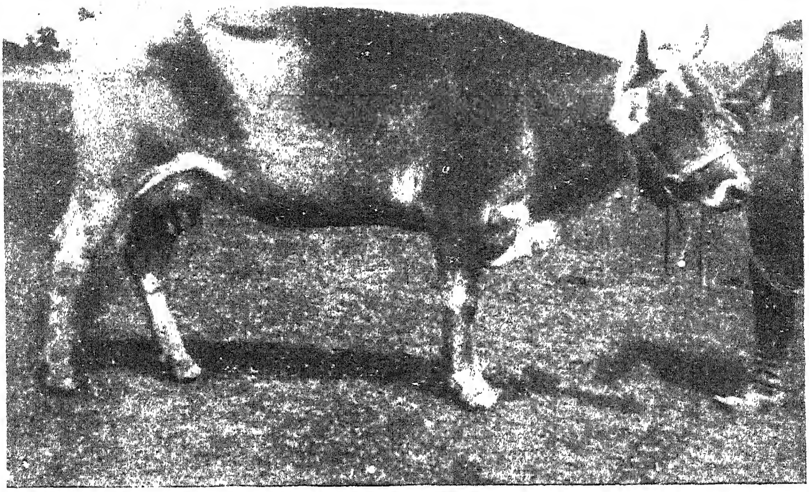


FIG. 235. — Brown Swiss cow bred in Roumania.

FIG. 236. — Herd of Dutch cows raised in Roumania.

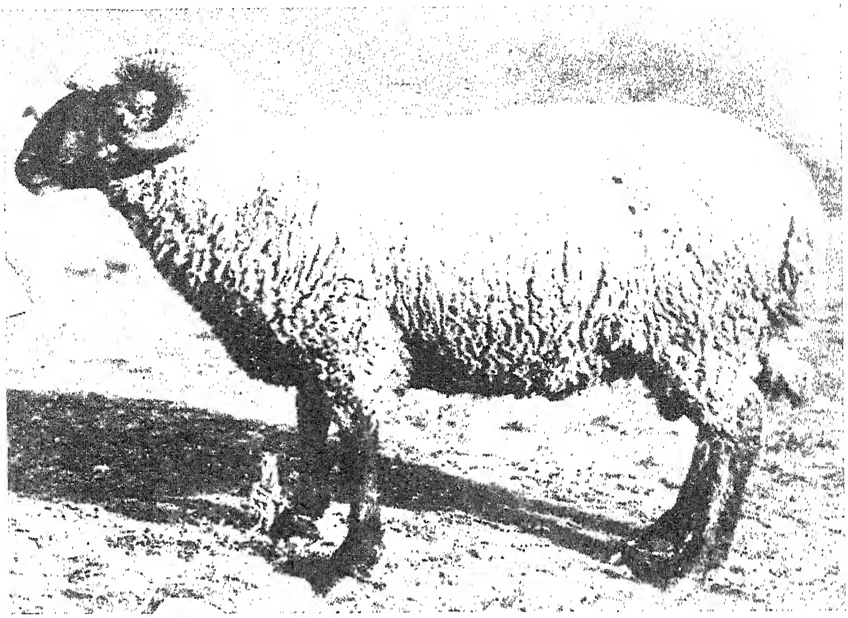


FIG. 237. — Ram, Tzigaia breed, White variety (after Filip).

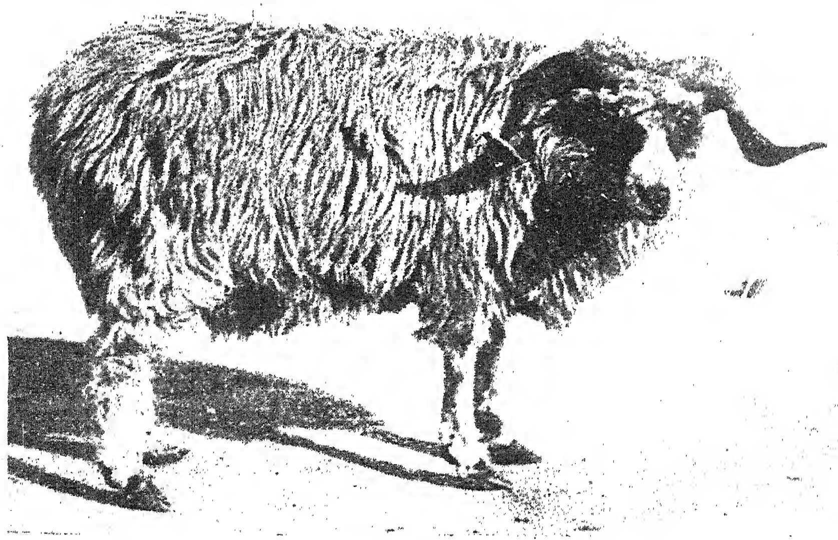


FIG. 238. — Tzurcana ram, white variety (after Filip).

PLATE LXXXVII.

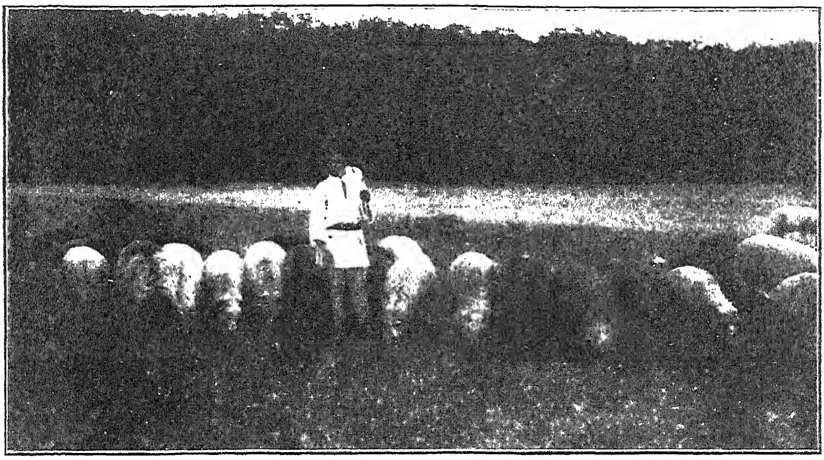


FIG. 239.— Flock of sheep at pasture, Tzurcana breed; black and white variety.

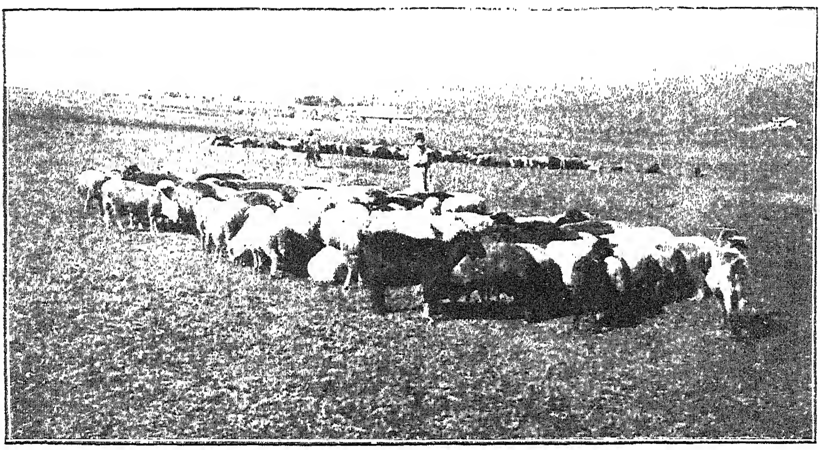


FIG. 240. — Flock of sheep at pasture, Spanca breed.

FIG. 241. — Karakul breed of sheep, raised in Roumania.

FIG. 242. — Karakul ram, bred in Roumania.

PLATE LXXXIX.

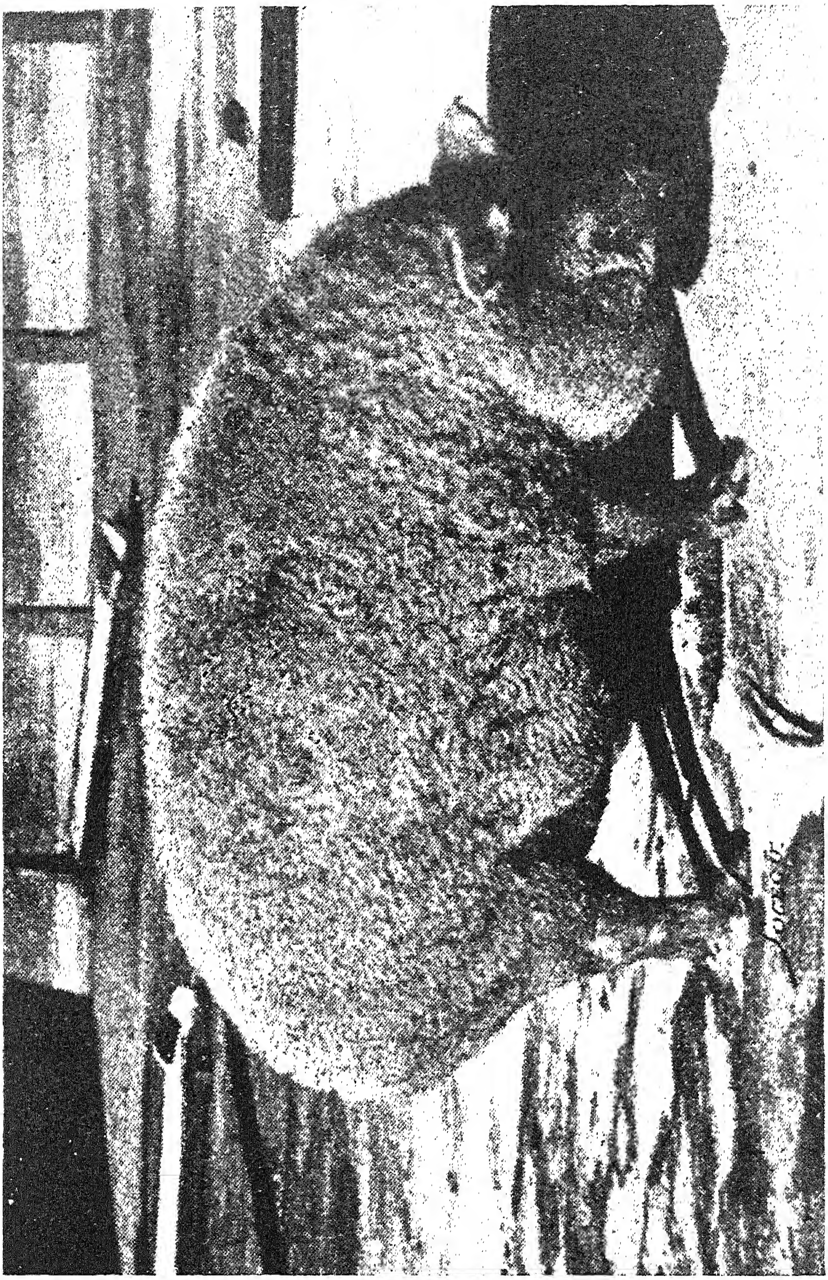


FIG. 242.—Mangalicza Sow (after Filip).

ash-coloured, lighter at the nape of the neck, the back and underneath, with a light zone round the muzzle, like the Schwyz breed. The mountain cows are better milch cows than those of the Steppe. Many of them give 10 litres of milk per day during the maximum period of lactation, with an average of 4-5 % of fat; their origin is still undecided, and it is not yet clear whether they spring from the acclimatisation of the Steppe breed to a mountain life, or are of other origin. The animal has been improved by crossing with the brown Swiss breed, but the work of selection is still in its initial stage.

B. *Imported breeds* raised successfully and on a large scale in Roumania, especially in Transylvania and the Banat, are the *Simmenthal* (figs. 231, Plate LXXXII; 232, Plate LXXXIII; 233, Plate LXXXIV) and the *Pinzgau* (fig. 234 LXXXIV) and in some mountainous districts, the *Schwyz* (fig. 235, Plate LXXXV). Attempts have been made to acclimatize the Shorthorn and other heavy, early-maturing butcher's beasts, but without success. Here and there Dutch cows are reared (fig. 236, Plate XXXV).

III. Breeds of Sheep.

A. *Autochthonous Breeds.* In Roumania there are two autochthonous types of sheep: (1) The *Tzigaia breed* (fig. 237, Plate LXXXVI) with fine wool (average 31 μ) is of two varieties: the white (head and extremities black, red or all plain white) and the black; (2) the *Tzurcana breed* (Zachelschaf) (figs. 238, LXXXVI; 239, Plate LXXXVII) with long, thick (56 μ) wool mixed with down, gives the varieties: *white, black* and *grey* (from the last named the grey lambskins are obtained) and the variety known as *ratzka*, with spiral horns, which is found in the districts along the Hungarian frontier. The cross between the Tzigaia and Tzurcana is called " *Stogoshes* ".

The Tzigaia and Tzurcana breeds furnish meat and milk in addition to wool. Certain cheeses are made with their milk, particularly a kind of gruyère (the " Cascaval "), also pressed cheese in skins (" Burduf "). The black Tzigaia is particularly noted for its meat; it comes from Dobruja and is also called the *Bulgarian sheep*, while the black Tzurcana has been largely crossed in Bessarabia with the *Karakul* breed to obtain highly appreciated black furs.

Besides these two breeds, the Spanca (fig. 240, Plate, LXXXVII) is found in Roumania. It originates from the Merino, but is autochthonous; its wool is also finer than that of the others (25 μ) and

it is mostly found in Dobruja and Bessarabia, where it has been crossed with the Merino.

B. As *foreign breeds*, the Merino, *Frisian* and Karacul (Buchara) are bred. The first two have been employed for crossing with the Tzigaia, but the result has not yet been subjected to a rigorous test in conformity with the modern knowledge of heredity. The Buchara is mostly reared in Bessarabia, but also in the Old Kingdom (figs. 241, 242, Plate LXXXVIII).

The *English butcher's breeds* have been introduced in very small numbers and are not much bred.

IV. Breeds of Goats.

Goats are not raised to any extent in Roumania. There is a native *Carpathian* breed, and the *Saanen* goat has also been imported, but not in large numbers.

V. Breeds of Pigs.

A. *Autochthonous breeds.* The most famous indigenous breed is characterised by a long snout, pointed straight ears, its back convex and having bristles along the fore part, a narrow breast, undeveloped hindquarters, and long trotters, thus resembling the boar in character. In the mountain areas they are smaller, and known as "*stocli*"; in the plain washed by the Danube they are larger, and known as *marsh pigs*.

There is also a local breed; according to Professor Filip, it is the *Palatine pig*, but is not numerous; it has drooping ears.

The *Bazna* is another autochthonous breed, originating in a locality of this name in Transylvania. It is characterised by its colour, black with a white band round the middle of the trunk. It is a cross between the Mangaliza and Berkshire breeds.

The *Mangalitza breed* (fig. 243, Plate LXXXIX) found in all the Balkan countries, is very numerous in Roumania; its hair is curly, and it is noted for fat production. There are two varieties: the *white* and the *black*.

As regards *imported breeds*, a large number of Yorkshire are reared in all parts, and the Berkshire, especially in Bessarabia.

VI. Breeds of Poultry.

The *common local* hen has all the characters of the Italian hen: it is generally partridge-coloured, sometimes white and more rarely black.

The *Transylvanian hen* is a native breed; the neck is denuded of feathers; the bird is a good layer.

All the other more important breeds of poultry existing in other countries are found in Roumania.

MEASURES FOR THE ENCOURAGEMENT OF BREEDING

I. State Intervention.

The stock breeding work of the State is under the General Stockbreeding and Veterinary Sanitary Administration of the Ministry of Agriculture. This General Administration is under the control of veterinary surgeons and has, as auxiliary consulting and executive organs, besides the General Stock Breeding Inspectors, a Higher Stock Breeding Council, and in each Department a Departmental Stock Breeding Commission. These Departmental Commissions have autonomous financial means derived from different sources.

The State takes part, both directly and indirectly, in the breeding of domestic animals.

A. The direct State intervention is comparatively important as the State possesses 5 national stud farms, 10 stallion depôts, 3 national breeding stations for cattle, 4 national sheep stations and several small pig-breeding farms.

The National stud farms are: (1) The *Redautzi Stud Farm* in Bucovina, installed in the grounds and in the buildings of the former Imperial Austrian Stud Farm, but in greatly reduced proportions; indeed, owing to the distribution of the land to the peasants in accordance with the Agricultural Reform, there remain scarcely more than 3279 ha., of which 2000 are occupied only by an isolated pasture on Mount Lucina. The half-bred Arab is reared on this farm; there are also some pure-breds and others of the *Hutzul* breed. The farm has 25 brood mares and 6 breeding stallions of Arab race. The following were the names of the stallions on this

National Sheep Runs. The national sheep runs of Roumania, of which the last three are still in process of formation, are :

(1) The *Pallas sheep farm*, in Dobruja, with an area of 650 ha, where the *Rambouillet merinoes* are bred ; it possesses 240 ewes and 10 rams.

(2) The *Brebeni sheep farm* in Wallachia, in the Olt Valley, with an area of 1450 ha., for the *early-maturing merino* : 300 ewes and 15 rams.

(3) The *Dulbanou sheep farm* in Wallachia, with an area of 400 ha., in the plain region (Buzeu Department) for the Karacul breed, with 120 ewes and 5 rams.

(4) The *Domitza sheep farm* also in Wallachia, in the plain region (R-Sarat Department) for the autochthonous Tzigaia breed, with an area of 1160 ha., and which is now being organised.

Swine-Breeding stations. These are installed near the different stud-farms and depôts already mentioned. They are of small size.

Public Loans free of interest. — Besides the breeding stock placed at the disposal of the public in the State depôts and distributed at reduced prices to the Communes and private persons, the State also grants the Communes loans without interest for acquiring *Communal breeding stock* consisting of bulls, boars and rams (but not stallions). A sum of 100,000,000 leis has been allotted for this purpose by a special law. With the aid of sums taken from this fund more than 100 Simmenthal and Schwyz bulls were imported from Switzerland in 1924.

B. — Indirect State Aid. — This takes the form of various prizes, grants, etc. The stock breeding commissions organise livestock shows in each Department ; the State contributes thereto by sums entrusted to these commissions, as well as by awarding medals and diplomas. In the larger Departments, where breeding is more intense, similar shows are also organised in the departmental districts also with the intervention of the stock breeding commissions. Besides these local exhibitions, larger exhibitions are organized from time to time for a whole Province. In 1923 one such was organised at Jassy for Moldavia, Bucovina and Bessarabia. In 1924 the Exhibition for Transylvania and the Banat took place at Cluj. For 1925 an Exhibition is being organised at Timisoara for the Banat only and another at Kisinau for Bessarabia.

PRIVATE INITIATIVE.

There are few stock breeding associations in Roumania.

There is a limited number of associations, but they are not organised like true, specific, breeding associations for improving a certain breed, basing on the pedigree register, but are rather associations of a general character with numerous objects in view.

The studbook of the English thoroughbred is kept by the Jockey Club, whose headquarters are at Bucharest. The Society for the Encouragement of Half-Breds at Braila has a studbook for the half-bred. The studbook for the trotter is kept by the National Society for the Encouragement of Horsebreeding (S.N.I.C.).

Finally, for the Simmenthal breed of cattle, the Brasse (Transylvania) Syndicate has a Herd-Book.

DR. G. K. CONSTANTINESCO,
Professor of Stock Breeding of the Faculty of Veterinary Medicine, Bucharest.

HEREDITY IN THE MULE.

How should the hereditary characters of the mule be interpreted ? This is a question we have treated in a preliminary way, in previous articles (1), by the aid of measurements taken during the war in the 1st Regiment of Mountain Artillery, of mules of various origin.

Our observations were necessarily incomplete for we did not know anything as to the forebears of the animals examined, a blank remained to be filled in, which has now been done thanks to the grant furnished by the " Fondation Loutreuil ". The grant has enabled us to study on the spot the Poitou mules and those of the Setif region in Algeria.

Before commencing to study the characters of the mule we must first examine those of its forebears, the asses and mares utilised in its production ; it will thus be easier to prove that if these hybrids have certain essential traits of resemblance, they nevertheless show a rather great comparative variability, resulting from the way in which the characters of either parent fuse or are placed in juxtaposition : *everything depends on the breeds of asses and mares brought together.*

I. The Poitou Ass.

The Poitou ass, which now has a worldwide reputation, is said to have been first imported into Spain by the Moors, and from thence introduced into the South of France via the Gulf of Gascony, or into Poitou through the small ports of the Vendée.

This hypothesis, which is taken from Ayrault (2) and is admitted by certain authors, is however only of secondary interest. From whatever part the ass was imported into Poitou, it must be observed that in this region — and for some time back — the finest animals are met with, which, with the Poitou mare, are capable of producing the most highly valued mules.

Averaging 1.44 m. high, in exceptional cases reaching 1.32 to

1.50 m. (3), the Poitou ass is remarkable for its large head with its wide flat forehead ; the orbital arches are widely separated from each other ; though prominent, it was not found that they give the animal a sombre and crafty appearance, as many authors have asserted ; though the eye is small, it is quick in movement.

The ears are wide, long, almost always well poised, standing above the head and bordered by long curling hairs known as "*Cadenettes*".

Under the lower jaws there are sometimes long hairs, forming a peculiar setting to the lower part of the head.

The neck is strong, short and furnished with a mane sufficiently long to hang down on the side.

The withers are not prominent and the lumbar-dorsal line is straight.

The longer the body, the higher are the asses valued for mule production ; the crupper is short, not wide, and the tail furnished with a small quantity of hair only at its extremity.

The breast is rather wide but is lacking in depth.

The shoulder is short and the foreleg also, and the latter is not thick ; the joints of the knees and hocks are as wide as in draught horses, and the shins are strong. When the hair on the lower part of the limbs, at the height of the fetlocks, is abundant, and that on the crown forms locks, covering part of the hoof, the animals are called "well heeled" ("bien talonnés, bien moustachés").

The coat is black or brown-bay ; in the latter case the lower part of the body is covered with white hair, extending and thinning out to the flat of the thighs.

The periphery of the mouth, nose and eyes is grey-white in colour ; the eyes are sometimes surrounded by a reddish aureole, which is lost in the deeper hair of the coat.

The asses belonging to certain owners are never groomed, and so the body hair becomes long and waved, forming fringed tufts of unequal length, somewhat resembling rags ; hence the name "*ragged*" given to these animals.

When well brushed they no longer have this peculiar hirsute aspect and the hair becomes short, as we have observed in some animals.

The attitude of the Poitou ass in nowise resembles that of the ordinary ass ; it is curious to see it, on leaving the stall, raise its head, prick its ears, advance at a trot and give a kind of plaintive bray.

The Poitou ass, though isolated the greater part of the time, is well fed; it is subjected to no ill-treatment, its only function being reproduction. Whereas the domestic ass, which, when it has reached an adult age, is often badly cared for, ill fed, beaten and overworked, and then has a sad air and seems resigned to its lot.

II. African Asses.

In Algiers several breeds of asses are used for mule production.

The native, as Trouette writes (4), pays no attention to the choice of the mare nor has any discernment in that of the ass.

" The Algerian ass, utilised as a stallion, varies in height from 1.15 to 1.30 m.; its skeleton is slender, joints narrow, hair not long, muscular masses dense and tendons well tempered ".

It is rather larger than the ordinary ass and has a black coat which becomes light over the belly. The price before the war was 150 to 200 francs.

The ass while serving is led from market to market; in an out-of-the-way corner its master couples it with as many mares as may be brought up, sometimes eight or ten in the same day (5). It is not surprising that after three or four months of this treatment the animal is exhausted and that at the end of the season its mounts are less fecund than at the beginning, as Trouette points out. The farmers engaged in the mule industry mostly utilise for their mares asses imported from the Balearics, Catalonia, the Pyrenees or Savoy.

" The latter, smaller than the Poitou asses, become better acclimatised in warm regions, their price is lower and they produce sufficiently good results ".

In the Setif districts, where mule production is very flourishing, for this region is tending to become " the Algerian Poitou ", there are, in addition to the 180 native asses, 1 Poitou ass, 3 from the Pyrenees, 16 from Savoy, which have been imported through the care of the Committee. In this region there are also animals springing from former Spanish crossings, made with a view to increased size.

The Catalonian ass is tall, long in the limb, with a narrow, slender, well shaped body; its neck is long and crupper narrow. The coat is short, fine, glossy and soft to the touch.

Trouette reports that recourse might perhaps be had to the Sahara and Egyptian asses.

The finest specimens of the first attain 1.25 m. in height.

PLATE XC.

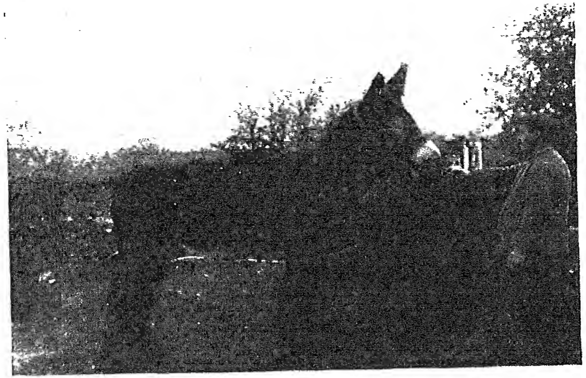


FIG. 244. — Poitou ass.

FIG. 245. — Algerian ass.

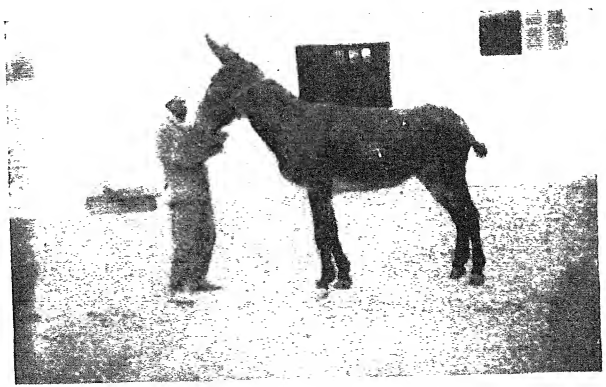


FIG. 246. — Pyrenean ass.

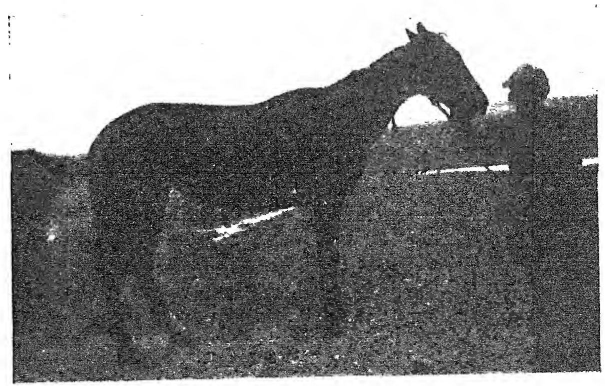


FIG. 247. — Berbera mare.

PLATE XCI.

FIG. 248. — Brittany mare.

FIG. 249. Stallion.

FIG. 250. — Poitou mare.

The Eyptian asses are 1.35 to 1.40 m. high, of ample body and rounded contour; they are both compact and elegant in form. These animals, living in warmer climates than that of Algeria, may be acclimatised with less risk, especially as their requirements in feed are rather restricted.

The attempt would not be costly and deserves a trial (TROUETTE), "since the price of these animals is one tenth of that of the Poitou and Gascony asses introduced in the Setif region".

In Algeria, stallion asses are under special supervision, with a view to prevent the propagation of dourine (General Government Decree, 4 March 1906). Further, a General State Decree (19 January 1907) was passed in order to combat the transmission of diseases such as: roaring, periodical fever and hereditary bone disease.

These measures are insufficient; in TROUETTE's opinion "it would be well also to require that the perimeter of the thorax of asses should be of minimum size, the shin also; and to leave it to the sanitary veterinary officials, or to special commissions, to judge as to form and within what limits service should be allowed or refused.

"In this way, by barring from reproduction a considerable number of valueless stallions, a production which is becoming more and more important every day, would be greatly imprvoed".

III. MEASUREMENTS.

A. Head — Neck — Trunk — Crupper. As is known, in the horse, the length of the head is three times its width taken immediately below the eyes; now, if from the measurements obtained by us we deduct, for Poitou animals, 2 to 3 cm. to allow for the excess resulting from the fact that the width was taken by us between the extreme points, i. e. from one orbit to the other, the length is still less than three times the width (6). In Algerian asses the head is smaller; in fact it is of normal size if we take into account the excess above mentioned.

The cephalic index is higher in the Poitou ass, which is brachycephalic, as pointed out by SANSON, whereas the African ass is dolichocephalic.

The width of the head is twice the length; here again it is seen that the head of the Poitou ass is generally broader, though in certain animals we found it of normal proportions. Generally speaking, the head of the Poitou ass is larger than that of the asses

examined in Algeria, which have a narrower, finer and less heavy head.

The length of the head is never equal to 2 ½ times the height of the withers; the proportion between these two dimensions varies from a maximum of 2.4 in the Spanish ass to a minimum of 2.1 in the Poitou ass, and averages 2.2 (7).

The same applies to the scapulo-ischial length, which is always less than 2 ½ heads; here however the average proportion seems to be rather higher, 2.3; in many animals it reaches 2.4. The length of the ass's ears is always greater than that of half the head; this is a true character in the Poitou asses, in which we obtained an average percentage, as compared with the length of the head, of 55.5, with a minimum of 49.2 and a maximum of 56.4.

In the Algerian asses examined the percentage was 48, 49 and 50.8. These therefore have shorter ears; we had already observed this character (8).

The ass has a short neck, 10 cm. less than the length of the head on an average, except in the case of a Spanish ass, in which it was found that the neck (60 cm.) was equal to a head (61 cm.).

The relation between the height of the chest and that of the saddle girth from the ground shows that the first is on an average less than a head in Poitou asses, but sometimes more by 1 to 2 cm.

The height of the chest in the African and Spanish asses is respectively about 1 $^1/_8$ and 1 $^1/_{15}$ of a head. The distance from the saddle girths to the ground is: about 1 ⅓ heads for the Poitou ass, 1 $^1/_8$ for the African and 1 $^2/_5$ for the Spanish.

Generally speaking this dimension is greater than that met with in the mare and mule. The crupper is shorter than in the horse; instead of measuring $^5/_6$ of a head it varies from $^2/_3$ to $^3/_4$ of a head in the Poitou and African ass, $^4/_5$ of a head in the Spanish and $^3/_4$ in the Pyrenean ass. The width was equal to or less than the length.

In all of them, the scapulo-ilial length is more than a head.

We observed that it was, 1 $^1/_7$ head in the Poitou ass, 1 $^1/_{10}$ in the African, 1 $^1/_5$ in the Spanish, 1 $_1/_8$ in the Pyrenean.

It is known that this last dimension — measured from the upper-rear angle of the scapula to the external angle of the hip — is dependent on the inclination of the shoulder and the shortness of the crupper; in the ass the crupper is short and the shoulder straight, hence this lengthening of the dorso-lumbary region, generally observed in the majority of animals.

B. *Fore and Hind Limbs.*

(*a*) Foreleg:

(1) *Poitou ass:* On an average the *shoulder* is shorter than the head by 9 cm., with variations of 10 to 7 cm.; it is equal to about $^7/_8$ of a head.

The *upper foreleg* is very short, averaging $^5/_9$ of a head.

The *lower foreleg*, from the tip of the elbow to the super-carpal is about $^2/_3$ of a head.

The *length of the shin* (from the super-carpal bone to the spur) is rather more than half the head.

The *metacarpo-digital region* (from the super-carpal bone to the ground) is $^3/_4$ of a head.

The *shin* is shorter than the *foreleg*.

The *foreleg* is shorter than the *metacarpo-digital region.*

(2) *The African, Spanish and Pyrenean ass.* The length of the *shoulder* in the Spanish ass is less than that of the head by 4 cm.; in the two others it is respectively about $^5/_6$ and $^6/_7$ of a head.

The *upper foreleg* is $^5/_9$ of a head in the African ass and $^3/_5$ in the Spanish and Pyrenean; it is therefore rather longer in the two latter.

The *lower foreleg* is about $^2/_3$ of a head, in some cases rather above or below.

Though the *shin* is half the length of the head in the African ass, it is decidedly longer in the two others and more than half the length of the head by several cm. The *metacarpo-digital* region is equal (1 cm. more) to the lower foreleg in the African ass; in the other two it is about ¼ of a head, and therefore longer than the antebrachial region.

Hindleg. In the Poitou and Algerian asses, as distinct from the Pyrenean ass and some Poitou asses, in which the patella is equidistant from the point of the rump and the outside angle of the ilium, the patella is generally nearer the ischial tuberosity than the hip; this is very marked in the Spanish ass, in which a depressed crupper was combined with a more prominent thigh; in these two species few animals showed a length of $^5/_6$ of a head; the average was $^3/_4$ of a head; they are therefore shorter in proportion to the horse.

The distance from the patella to the point of the hock, is near that from the ischial tip to the patella in the African and Pyrenean asses. In the Spanish ass it is more than 10 cm.

The distance from the point of the hock to the spur is governed by nearly the same conditions as the preceding.

In the Poitou asses, the distance from the patella to the point of the hock is greater than the other two dimensions; that from the point of the hock to the spur is slightly less than that from the point of the rump to the patella.

The distance from the point of the hock to the ground is equal to the head in the Spanish ass; in the other animals it is less than the length of the head by some centimetres (from 2 to 5).

On comparing certain lines of radiation in the fore and hind limbs we find:

(1) that the distance from the point of the hock to the ground is greater than that from the super-carpal bone to the ground;

(2) that the distance from the point of the hock to the spur is greater than that from the super-carpal bone to the spur;

(3) that the two distances from the tip of the elbow to the ground and from the patella to the ground, are often equal, and when not so, the latter is the greater.

C. *Indices.*

1. *Total Cephalic Index*: This index is the relation between the maximum breadth and length of the head, the latter being taken as 100.

As we have already observed above, this index is generally higher in the Poitou ass.

2. *Body Index.* — This is furnished by the relation between the scapulo-ischial length and the thoracic perimeter, taken as 100. The nearer the scapulo ischial length to the thoracic perimeter the higher is this index, and this is observed on the longitudinal lines. With the exception of two animals, in which the index was 86.8 and 87.5, all the others gave a proportion of above 90, and this figure is met with in the elongated forms.

3. *Thoracic index.* — This indicates the variations in the form of the breast, and is expressed by the relation between the greatest width of this region, measured with the aid of callipers at the most convex point of the ribs, and the height.

As is known, in the horse this index is 90 for heavy draught horses, 87 for average horses and 85 for those of elongated shape; in the ass, in which the ribs are short and rather flat, we obtained an average of

80.4 for Poitou asses; the index however is higher in the Pyrenean ass (89.6); it is lower in the African and Spanish asses (76.9 and 75.8).

Exceptions were found in the case of the Poitou breed, in which the index reached 91.5 and 92.8.

4. *Pectoral Index. Height of the breast* (vide sub-sternal). — The minimum recommended in the horse is $^4/_5$. This proportion averages 74.4 or $^3/_4$ in the Poitou ass; it however reaches $^4/_5$ in some animals of this race and $^1/_1$ in the African ass.

5. *Crupper Index.* Width, Length - the length being taken as 100. — The average index is 96.4 for the Poitou ass. It is lower in the Spanish and Pyrenean asses, and reaches 100 in the African ass. In small animals of this breed, of an average height of 0.95 m., we previously noticed that the crupper was rather often wider than it was long.

6. *Draught Index.* — This is furnished by the average of the chest measurements and of the width of the crupper, as compared with the height (or more exactly with the number of cm. over a metre). The formula is:

$$I = \frac{\frac{p + h}{2}}{T - 100}$$

in which p = chest, h = width of haunches and T = height in cm.

In the draught horse which should be broad in the breast and crupper, this index is of real value; the best, that which suitably combines strength with speed, is 79.69 (9).

It may be said that in the ass, the draught index is not so important, but is given in order later to make comparison with the mule. It averages 95.0 in the Poitou ass.

7. *Dactylo-thoracic index.* — This is the relation between the perimeter of the shin and that of the thorax; it may be expressed by the ratio: $\frac{d}{t}$ or $\frac{t}{d}$.

The ratio is higher in the Poitou ass, which has greatly developed shins.

Mares for Mule-breeding.

A. in *Algeria*: In most cases, writes Trouette, " only worn-out, defective animals are coupled with the ass. This by the way is

a means of utilising those of no value, which was formerly, and still is, suggested by the Remount Service, desirous of excluding from horse-breeding, defective mares ".

On comparing the Barbary and Poitou mares our colleague pointed out that : " more than any other mares in the world, the former are ' internally mule producers ' ; whereas, indeed, 10 Poitou mares produce only 5 mules, 10 of the small Barbary mares produce 7 ". Native and European methods of breeding should also be considered.

The native pays no attention to the choice of the mare ; " it is as God made it " (TROUETTE).

With Europeans, the mares are generally stronger, better set up and often less defective than those of the natives.

Besides their breeding functions, they take part in farm work ; the breeders therefore exercise more care in choosing their mule producers. Some have bought French mares, which they pair with imported asses.

While on this subject, without entering into questions which do not come within the scope of this article, we will simply mention that in TROUETTE's opinion, in Algeria the breeding of the mule of from 350 to 400 kg. is preferable ; he therefore advises not to insist on producing the equivalent of the Poitou mule — which would be difficult in many places — but only an animal of larger size, heavier body, and stronger than the present Algerian mule.

This result may be obtained *" by a careful selection of mares, the use of imported stallions, and scientific feeding "*.

The French mares imported for mule production are mostly of Brittany breed. Mares produced by crossing the Brittany stallion with the Barbary mare are preferred for this purpose.

By absorption crossing, to the 3rd and 4th generation, animals are obtained which are remarkable for their size and weight, and are perfectly suitable for the mule industry.

B. *In Poitou.* Contrary to what takes place in Algeria, the Poitou mare is exclusively reserved for mule breeding ; this is its only function throughout its existence : the Poitou farmer only breeds horses when his mares cannot produce mules.

At all times the Poitou breeders have attributed great importance to the choice of the mare in mule breeding.

While retaining certain characters of the old Poitou breed, the present mule breeding mare has been modified by crossings with heavy

draught breeds, such as the Boulogne, Percheron, and especially the Brittany.

Of large size and developed muscular system, the Poitou mare has a long body, low breast, rounded flank and wide powerful crupper. The forelegs are remarkable for their length and muscle, the shins are short and thick, the hoofs broad and flat, which character is accentuated by the fact that these mares are rarely shod. Grey or black coats are most esteemed; the hair of the mane, tail and limbs is long and abundant.

The more abundant, long and thick the hair and the purer the breed of the animal, the more it impresses its individual character (on the offspring).

The Poitou mares have a long, broad, thick head, the length of which is less than 2 $^1/_2$ times the height to the withers; the proportion is greater when compared with the scapulo-ischial dimension; the Poitou mares, like those of Barbary, which we have measured, are greater in length than height, and a certain amount of importance is attributed to this character in Poitou in mule breeding.

The scapulo-ilial length, in the Barbary and Poitou mares, is always greater than the length of the head.

The ears are longer in the Poitou mares; the length varies from 31.8 to 26.1 % of the length of the head; the proportion is lower in Barbary mares, being 27.5 to 29.3 %.

The height of the chest is almost equal to the distance from the sternum to the ground; in the Poitou mares the breast is lower than in the Barbary mares; in both cases the sub-sternal hollow is much less than in the ass.

***

The various indices lead to the following conclusions:

(1) *The cephalic index*; is greater in the Poitou mares.

(2) *The body index varies;* it averages 86.54 in the last named.

In the Barbary mares it is higher; they consequently have a more elongated form.

(3) *The thoracic index* is greater in the Poitou mares.

(4) *The pectoral index* shows that in the last named the height of the breast is approximately the distance from the sternum to the ground; sometimes these two dimensions are equal; in one case the sub-sternum hollow was less than the height of the chest.

(5) *The crupper index.* The crupper is always broader than it is long, and very much so in the Poitou mares with their haunches wide apart.

(6) *The draught index,* very high in the last named, shows their value as draught animals.

(7) *The dactylothoracic index* is slightly higher in the Poitou mares.

MULES.

The various authors who have written about mules have not always given a true description of this hybrid.

Many attribute to it exclusively a greater number of asinine characters; others consider the mule does not differ materially from the mare, apart from the characters regarding the ears, tail and hoofs (12). How are the paternal and maternal characters distributed? It would be interesting to cite the chief opinions on this subject. BUFFON, when considering the mule, concludes that the sire gives the extremities (head, tail, limbs), the external characters (skin and hair), the organs of sense and temperament; while the mother imparts height, the shape of the trunk, the internal organs, strength, variety and character.

According to ISIDORE GEOFFROY SAINT-HILAIRE, hybrids are not always in the proportion of half-and-half; they are, nevertheless, always mixed, and even form true intermediate forms.

In this author's opinion there may be a more or less close fusion between the two original types, or, on the contrary, a simple mixing of these types by juxtaposition of characters taken from each of them.

ED. PERRIER and Dr. BROCA think that there is no constant and fixed rule which would enable one to foresee how the characters of hybrids are formed.

In some cases there are such differences that no theoretic data would enable one to foretell before the test.

In GRAGNIER's opinion (13) the mule takes after its sire in form and after its mother in body volume.

Hybrids, like half-breds, writes SANSON (14), are subject to the laws of heredity, everything depending on the power of hereditary transmission of the animals paired.

In mules, the paternal and maternal characters are distributed in greatly varying proportions, now some, now others predominating, while sometimes the proportions are almost equal.

PLATE XCII.

FIG. 251. — Poitou mare.

FIG. 252. — Algerian mule.

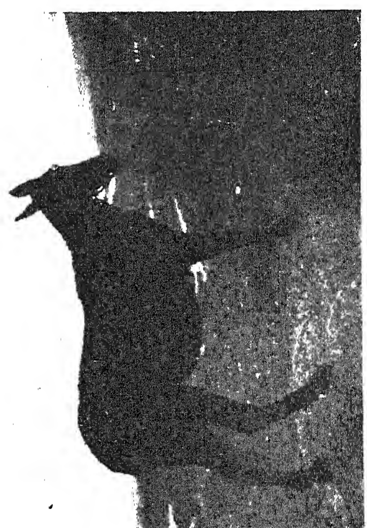


FIG. 253. — Algerian mule.

FIG. 254. — Poitou mule.

Plate XCIII.

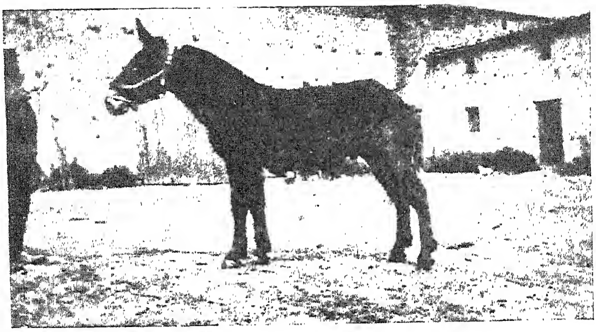


Fig. 255. — Poitou mule.

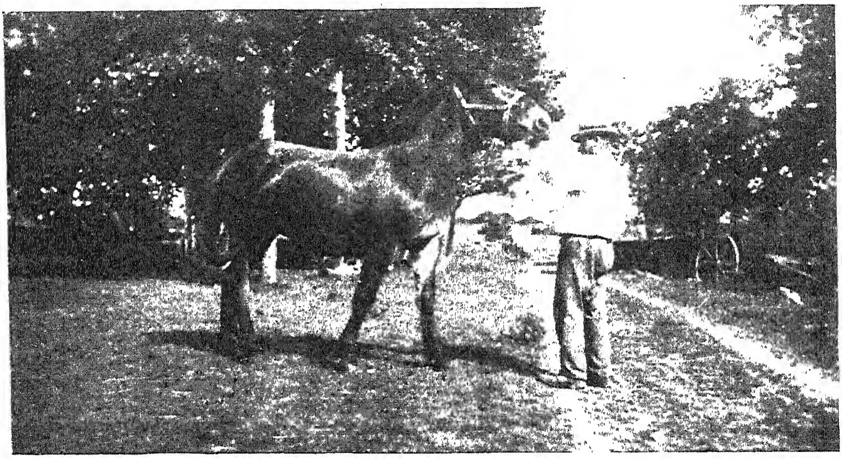
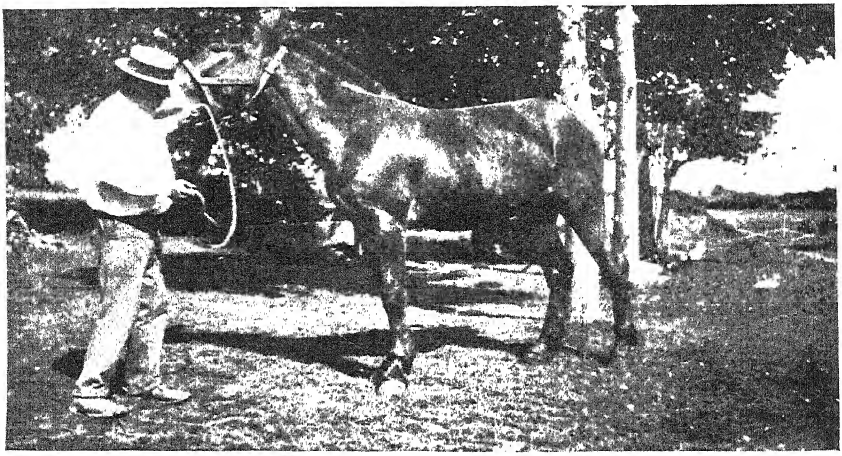


Fig. 256. — Poitou mule.



In BARON's opinion (15) the contour of the mule is more asinine than horse-like. Mules, like the offspring of the stallion and she-ass, show rather considerable relative variability, resulting from the way in which the characters of the two parents fuse or are juxtaposed; everything depends on the breed of ass and horse employed.

CORNEVIN (16) writes as follows in his description of hybrids: "The conformation of hybrids must necessarily vary in proportion to the hereditary influence of sex, species, breed and atavism, allowance being made for surroundings and individuation.

"In the body taken as a whole, parts are sometimes met with which, being furnished in their entirety by one species, exist side by side with those brought by another species.

"Some mules have the head entirely asinine, and horses' hoofs, or vice versa.

"The dissimilarities of these hybrids especially concern the dimensions and carriage of the ears, and the shape of the hoofs; it seems that in these two respects the individual influence of the reproducers is greater than that of the species.

"If observations are carried out on a large number, one must admit that the majority of the hybrids of the same class have characters in common, they are of the same style of build and their framework is on the same plan. The struggle between the two specific heredities leads to an arrangement which, after allowing for individual heredities, follows general laws. This arrangement gives one the impression that one of the constituant species predominates. Thus, in its external characters, the mule gives one the impression that it takes after the ass more than the horse, the mulard more after the Barbary duck than the ordinary duck, and the caquard more after the pheasant than the hen".

In BAILLET's opinion (17) the species which appears to preponderate in the conformation, organisation and temperament of the product in the act of generation, is generally the species which has the most fixed characteristics.

In the pairing of a wild with a domestic species the former having retained all the attributes of the specific type, transmits most of its characters; with two domestic species, the product takes most after that one which has been least modified by domesticity, but though one of the two species predominates there is always a combination of a certain number of paternal and maternal characters.

In LESBRE's opinion (18) the mule takes after both its ascendants,

but generally more after the ass than the horse as regards its external characteristics, its conformation and structure.

This distribution did not seem to differ in either sex. "It should be noted", says LESBRE, "that most of the conformation traits are mixed, but their fusion is very unequal: the amalgamation varies according to the characters, and also for the same character according to individuals".

The union of two domesticated species gives dissimilar products because in themselves they possess no stable qualities.

"In the union of one of our domestic dogs", writes SUCHELET (19), "with a wolf or jackal, we must not be surprised to meet with young ones of different types in the same litter, the dog having undergone numerous transformations. If asses and horses be paired, dissimilar mules may be expected, the horse and ass species having undergone great modifications from their original form and colour".

Indeed, though in all mules there is a certain likeness in outward form, whatever the mares and asses they come from, they show numerous variations among themselves, as we noticed from the numerous measurements taken during the war, in Algeria, or in Poitou.

This must be interpreted not only as the influence of heredities brought into contact, but perhaps also these variations are the result of the interactions of the complex "*organism × environment*" (20).

The mule really has an asinine form made more evident by the length of its ears, shorter than those of the ass, longer than those of the horse.

This character alone is almost sufficient of itself to give it the aspect of the ass; it is easy to change the physionomy of certain horses and mules by modifying the length of the ears, as may be seen from photographs 258 and 259.

Photograph 258 shows a troop mare with a large head, prominent orbital arches and the ears of which have been lengthened; photograph 259, on the contrary, is that of a mule, the ears of which have been shortened. The mule takes after both its ascendents, and it cannot be denied that the mare has a very great influence on its conformation.

The Poitou breeders have already long attributed great importance to the choice of the mare. One should read how energetically BUJAULT protested in 1834 against a report to the Prefect from the Manager of the Saint-Maixent stud, in which it had been proposed to replace the Poitou breed by the Norman.

PLATE XCIV.

FIG. 258.—Military mare with long ears.

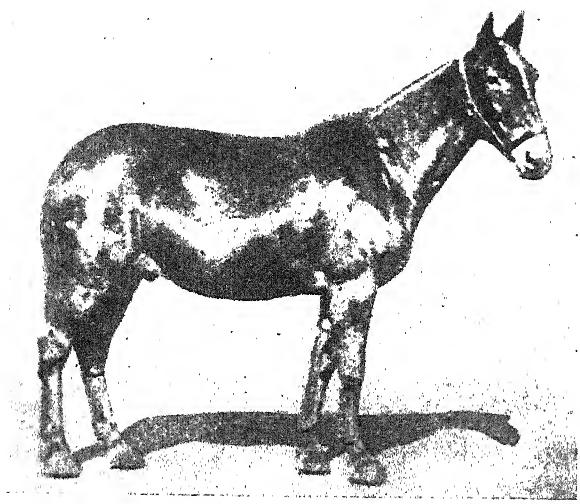


FIG. 259. Mule with shortened ears.

" To make the Norman into a mule-producing breed is the purest folly ", he says, " which has ever entered the head of a man. This breed will be called the Manager's breed ! " (21).

Undoubtedly the Poitou mules, the reputation of which is universal, owe their form to full bodied mares, chosen for mule production.

COMPARISON BETWEEN THE ALGERIAN AND POITOU MULES.

A. — Head, Neck, Trunk, Crupper. The Poitou mule as compared with the Algerian, has a longer, wider, heavier head, and long ears, which character it inherits from its two progenitors.

The head of the Algerian mule likewise in consequence, of hereditary influences, is, on the contrary, generally finer, on the whole, and often shows the sinuous or convex profile of the Barbary mare.

The average length of its ears in % of head is 38.7, while it attains 42 in the Poitou mule.

The neck of the Algerian mule shows variations in length which it is interesting to note ; generally shorter than the head, we found it in some cases equal or longer.

It is not the same with the Poitou mule, in which the length of the neck was always less than that of the head by some centimetres, in the animals we examined.

The average difference between the length of the neck and that of the head is less in the Algerian — this being the result of inherited qualities.

The height to the withers and the scapulo-ischial length give an average of 2.3 heads for the Poitou mule and 2.4 heads for the Algerian, this depending on the length of the head, which is greater in the former.

The scapulo-ilial length is greater in both cases than that of the head by some centimetres, a character which is found in the progenitors, often more accentuated in the ass and the Poitou mare.

The height of the breast is equal to $1\,{}^{1}/_{10}$ heads for the Algerian mule, and $1\,{}^{1}/_{15}$ heads for the Poitou mule.

The difference between the last named dimension and the distance from the sternum to the ground is : $79.7 - 67 = 12.7$ for the former, and $85.4 - 71.1 = 14.3$ for the latter ; we find a sub-sternal hollow less than that of the ass and greatly superior to that of the mare, especially in the Poitou mules.

The crupper in the Algerian mule is often longer than it is wide; on the whole these two dimensions are almost equal.

In the Poitou mule the width is always greater than the length, which character it takes from its mother, the Poitou mare, with her broad and powerful crupper.

The Algerian mules from Brittany mares or half-breds are slightly wider in the crupper, as we noticed in certain animals.

The sex of mules, of Algerian mules at least, seems to have no influence in this matter, the number of males with a broader or narrower crupper being almost equal to that of the females.

In the Algerian mule, the length and breadth of the crupper is about $^3/_4$ of the head in the case of the Poiton mule, the lenglh is nearly $^3/_4$ of the head, and the width $^5/_6$.

B. *Fore and hind limbs.* (a) *Fore limb. Shoulder.* — The length of the shoulder is, on an average, in both cases, less than that of the head, but though the difference is very small in the Algerian mule, it is rather more in the Poitou mule.

The shoulder of Algerian mules is often as long as the head, that of Poitou mules is shorter than the head by from 2 to 10 cm.

Foreleg. — (*a*) The Algerian mule: its length varies from $^2/_5$ to $^2/_3$ of the head. (*b*) The Poitou mule: the foreleg is about $^3/_5$ of a head.

Foreleg, shin, metacarpo-digital region. As we had already noticed, the antibrachial region has always proved shorter than the metacarpo-digital region. The difference is 5.85 in the Algerian mule and 4.4 in the Poitou. The latter therefore has a longer foreleg.

The height being taken as 100, the metacarpo-digital region is 4.4 cm. longer than the foreleg in the Algerian mule and 2.8 in the Poitou.

These regions as compared with the length of the head are:

	Algerian mule	Poitou mule
Foreleg	$^2/_3$ of head	$^3/_4$ of head
Metacarpo-digital region	$^4/_5$,,	*id.*

The shin region exceeds half the length of the head by 2.95 cm. in the Algerian mule and 3 cm. in the Poitou.

(b) *Hind limb.* — The distance from the point of the rump to the patella and that from the hip to the patella, differ but slightly in the Algerian mule, which is a good sign for the construction of the hind limb. The length of these two lines is about $^4/_5$ of a head.

The distance from the patella to the point of the hock is about $^5/_6$ of a head.

We found the distance from the point of the hock to the ground in individual cases, greater, equal to, or less than a head ; on an average, it is slightly less.

In the Poitou mule the patella is farther from the hip than from the ischial tuberosity, i. e. it has a more depressed crupper, or a vertical thigh.

The same thing, by the way, is found in its two progenitors.

The distance from the point of the rump to the patella is about $^3/_4$ of a head. That from the hip to the patella is about $^4/_5$ of a head.

The distance from the patella to the point of the hock is greater than that observed in the Algerian mule, for it is nearly a head.

The distance from the point of the hock to the ground is on an average slightly less than a head.

In both cases, the distance from the point of the hock to the spur is nearly that from the point of the rump to the patella.

These various measurements of the hind limb are very variable in the mule, approaching those now of the horse, now of the ass, and often intermediary between the two.

***

If we compare the distances from the point of the elbow to the ground and from the patella to the ground in the Algerian and Poitou mules, we find that the difference is greater in the former than in the latter in which these two dimensions are nearly equivalent.

Expressed in head length, we obtain the following proportions :

	Point of the elbow to the ground	Patella to the ground
(*a*) Algerian mule	1 $^1/_2$ heads	1 $^2/_5$ to 1 $^3/_5$ heads
(*b*) Poitou mule	1 $^2/_5$ to 1 $^3/_5$ heads	*id.*

The difference between the distance from the point of the elbow to the ground and that from the sternum to the ground is greater by some cm. in the Poitou mule. Its elbow is higher up on the breast ribs.

C. THE INDICES. 1. — The total *cephalic index* is higher in the Poitou mule : we have seen indeed that the latter has a broader head than the Algerian mule.

2. — The *body index* again is greater in the Poitou mule ; when above 90 it indicates a longilineal animal. There are numerous vaiations in the Algerian mule ; the average is 89.26.

Only in one case did we find a body index equal to 83.8, in a mule showing a very developed thoracic perimeter, prominent withers, a high breast, flat ribs and scapulo-ischial length less than the height to the withers.

3. — *The thoracic index.* That this is low in the mule is due to the fact that its breast is generally elliptic and its flank rather flat, which character it takes from its sire the ass.

The shape of the breast indeed has a considerable influence on the value of the thoracic index, which may be low in animals comparatively short, but with an elliptic breast.

On the other hand, the thoracic index was very high in two African mules, one from a Brittany mare, the other from a Barbary mare, with broad breast and rounded ribs.

4. — *The pectoral index* is 84.37 in the African mule and 83.25 in the Poitou, or $^5/_6$ in either case.

5. — *The draught index,* which we determined only in the Poitou mule, shows that this animal is excellently formed for draught work ; on an average it attains to 83.67.

6. — *The crupper index* is higher in the Poitou mule, in which we always found the crupper wider than it was long.

7. — *The dactylo-thoracic index* is slightly higher in the Poitou mule, the shins of which are more developed than those of the Algerian mules.

In the body index, the mule is nearer the ass ; in the others it is mostly nearer the horse, or intermediary between the two reproducers.

D. — Examination of general conformation. — On the whole, the following description may be applied to these two mules :

" The Algerian mule ", writes H. Geoffroy St. Hilaire, varies, from 1.30 m. to 1.50 m. in height ; some are small, lean and curtailed others are near the ground, thick set and of good muscular development ; certain of them are large and full-bodied : all these characters vary according to the different animals used in a system of breeding which, though not despised by the natives, is not based on such exact principles for improvement as are adopted in horse-breeding.

Geographic and food factors play an important part in the more or less extended development of these valuable animals (22).

The characters we have observed in the mules from the Setif region may be summarised thus:

The majority of the mules out of Barbary mares have a long thin head, narrow at the lower extremity; the profile varies, and is mostly straight, but rather frequently sinuous and convex, the forehead is flat or slightly convex, the orbital arches generally are not very prominent, the eyes large and expressive and the ears comparatively short and rarely drooping.

The neck stands out well and is thin, the hair of the mane abundant, that of the tail less so, the crupper is narrow, short and flattened, as in the Barb, and the breast is well developed and deep.

The limbs are generally rather slender; the shoulder is long in most cases, the forelegs rather short, the shins wide with well-detached tendons; the fore-hoofs are rather rounded and the hind ones often nearly like those of the horse (23).

The skin is supple and fine, with short, fine hair.

Of 27 animals examined by us, 19 had 4 warty growths, a proportion of 70.3 %.

The Algerian mules bred around the tent, "douar" or farms, in complete liberty, are generally very mild, and we had no difficulty in taking the various measurements we needed.

Mules coming from Brittany mares generally appear more thickset and lower; the neck is shorter and more massive, the limbs are generally stronger in the shins and joints, the flank rounder, the breast broader, and the crupper broader and less flattened.

The Poitou mule may be considered as the draught mule "par excellence"; it averages 1.56 m. in height and is sometimes as much as 1.60 m. or even more.

The head is powerful, with a straight profile, sometimes slightly convex at the base of the forehead, the lips are sometimes thick, the prominence of the orbital arches varies and is often but slight; the ears are longer and wider than those of the Algerian mule; the neck is strong and furnished with an abundant mane and forelock; the withers stand out well, without being prominent, the back is straight and well supported, the breast high and the flank sometimes lacks rotundity; the crupper is short, muscular and frequently rounded; the hair of the tail is abundant.

The limbs on the whole are well developed; the shoulder is short, the forelegs shorter than the metacarpo-digital region; the shins

are strong and the joints of the knee, hock and fetlock broad and strong.

The fore-hoofs are slightly rounded and the hind-hoofs often nearly like those of the horse.

Of 7 mules which we measured, 5 had 4 warty growths. Generally speaking, the mule shows the greatest faults of conformation principally in the hind quarters; the crupper is often short and hollow, the haunches sloping, the thighs lean, and the hind limbs angular.

The conformation of mules greatly varies, and no one description can be applied to them: not one only but many mules differ from one another greatly, according to their origin; this is a matter of true heredity in their case, as in that of animals resulting from crossing different races.

It is an exaggeration to say that all mules have a heavy, bulky head, prominent orbital arches, a more or less sharply ridged back and a hollow or "mule" crupper. Having had the opportunity of measuring mules, as well as their sires and mothers, we noted that the distribution of characters is in the following proportion:

Distribution of characters of the ass and horse.

	Characters of ass %	Characters of horse %	Intermediary characters %
A. She mule from an African ass and a Barbary mare	37	22	40
B. Mule from a Pyrenean ass and a Brittany mare	28.5	28.5	42
C. Mule from the same ass and a Barbary mare	24.3	40.5	35.1
D. She mule from a Poitou ass and mare	20.9	34.8	44.1
E. Mule from a Poitou ass and mare. .	23.5	35.2	41.1
F. She mule from the same ass and a Poitou mare	12.1	57.5	30.3

Conclusions.

From the numerous measurements we have taken, both on mules and their ascendents, it may be concluded that the distribution of paternal or maternal characters in these hybrids shows very great variability.

It should nevertheless be observed that the intermediary charac-

ters resulting from the fusion are always stronger than those received from the ass.

In the Poitou mules, the characters received from the mares predominate, sometimes in a very evident manner; the same is true in some cases with Algerian mules; the greatest care therefore should be taken in choosing the mare for mule production.

The hereditary phenomena, whether it is a case of crossing breeds or species, are similar; the offspring always takes after both its ascendents, in varied proportions.

Though the mule's extremities (head, hoofs) recall those of the ass, rather than the horse, they show numerous variations; the ears, for instance, differ greatly in length, sometimes approaching those of the ass, though always shorter, sometimes those of the mare, though always longer. The same applies to the hairs of the mane, and even the hoofs.

Both sexes, as shown by SANSON in numerous examples taken from among half-breds or hybrids, have at first an equal hereditary influence on their offspring.

"Variations depend on the individual hereditary power, which is no more inherent in one sex than in the other, and concerns no portion of the body in particular" (24).

To understand the mechanism of heredity well, writes ETIENNE RABAUD, the nature of the living substance should first be known (25).

"The nucleus and cellular body forming one whole, constitute an association of proteic or other colloids and electrolytic solutions. In this association the factors are neither autonomous nor independent; they are in close relation with one another, and *form a complex unit of which all the components influence one another reciprocally*". These different component parts of living matter have been denominated by DANTEC "*plastic substances*".

According to E. RABAUD, when the spermatozoid penetrates into the ovary, reactions which are by no means always of the same intensity are produced by the union of these two substances.

This interaction of substances is not the only factor,

"The egg proceeds to make exchanges with the surroundings in which it lives, it takes some materials and rejects others; all evidence points to the fact that the actions exercised by these surroundings on the plastic substance modify their activity and consequently their interaction".

When the organisms are closely related, as happens in animals of

the same pure breeds, their complexes contain similar plastic substances, and consequently bring about very analagous conditions. In the union of heterogenous organic complexes, like those of individuals of different species or races, the results are quite different.

" Some in relation with others form entirely new surroundings, and the different plastic substances no longer produce the same effects ".

This action of the organic complex, according to the number and nature of the plastic substances which compose it, is not a true hypothesis, but the application of the most recent knowledge acquired on the constitution of living matter (26).

In this connexion, the works by MAYER and SCHOEFFER (27) on " *the cellular constants* ", cited by RABAUD, constitute valuable arguments in favour of the physico-chemical theory of heredity. We should be going beyond the scope of our work if we entered further into the question of the mechanism of heredity, but we desired to draw attention to " the physico-chemical theory " of E. RABAUD, which is based on facts, and which, in our humble opinion, permits of a better interpretation of heredity in the mule.

***

We desire to thank the members of the " Loutreuil Foundation " who have kindly granted us a subsidy and thus enabled us to make this comparative study.

We also thank MM. AUDUREAU, CARRZAT, A. CHOLLET and Ch. LEVY, agriculturists; our colleagues CANAC, CROSSETTI, CAPTAIN CAILLAT of Setif (Algiers), MM. FERRUYON, GAUDIN MOREAU and TAUNAY, breeders in the Two Sèvres; our colleague RENAUD DE ST. GELAIS (Deux-Sèvres), who accorded us a kind reception and placed at our disposal the materials for our work; and finally M. JEAN PORCHEREL, Agricultural Adviser at Setif, to whom we owe the photographs in this article relating to Algeria.

A. PORCHEREL,

Director of Zootechnical Research,
National Veterinary School, Lyons.

NOTES AND LITERATURE.

(1) A. PORCHEREL. Etudes métriques sur le mulet. Les Indices du mulet. — *Journal de Médecine Vétérinaire et de Zootechnie* — Juin-Juillet, 1920.
(2) EUGÈNE AYRAULT. De l'industrie mulassière en Poitou.
(3) These figures agree exactly with those obtained by Gustave ROBERT with 117 asses of all ages, measured by the author. GUSTAVE ROBERT. Le Baudet du Poitou. *J. d'Agriculture Pratique*, 1892.
(4) TROUETTE. L'industrie mulassière en Algérie, 1914.
(5) TROUETTE, *loc. cit.*
(6) We have always found in the case of mules as well as with horses, an average of 2-3 cm. more when the width was measured from one orbit to the other, instead of below the eyes.
(7) This relation may also be influenced by the lower body, and less protuberance of the withers.
(8) POFCHEREL, *loc. cit.*
(9) SANTANBIEN. Recherches statiques sur le modèle du cheval d'artillerie. *Revue Vre. Mre.* 30 Septembre, 1913.
(10) TROUETTE, *loc. cit.*
(11) EUGÈNE SAGOT. Les livres généalogiques des races françaises d'animaux.
(12) J. O. WILLIAMS. Mule Production. *Department of Agriculture, Farms Bulletin n.* 1341 (Traduction J. Porcherel).
(13) GROGNIER. Cours de Multiplication et de perfectionnement des animaux domestiques.
(14) SANSON. *Traité de zootechnie*. T. II.
(15) BARON. Méthodes de reproduction.
(16) CORNEVIN. Traité de Zootechnie générale.
(17) BAILLET. Sur les hybridations considérées dans leurs rapports avec la Zootechnie.
(18) LESBRE. Hybrides, Hybridité, Hybridation considérés principalement dans le règne animal. Lyon, 1921.
(19) SUCHET. *loc. cit.*
(20) See, On the subject of heredity, RABAUD. Le transformisme et l'expérience. — RABAUD. L'hérédité.
(21) EUGÈNE AYRAULT, *loc. cit.*
(22) H. GEOFFROY ST. HILAIRE. L'Elevage dans l'Afrique du Nord.
(23) Algerian mules are often not shod in the plains.
(24) A. SANSON. *Traité de zoot. générale*. Tome II.
(25) ETIENNE RABAUD. L'hérédité.
(26) ETIENNE RABAUD, *loc. cit.*
(27) MAYER and SCHAEFFER. Recherches sur les constantes cellulaires. *Journal de physiologie et de pathologie générale*, 1294.

STATE OF THE CEREAL CROPS AND TRADE IN ROUMANIA.

Roumania is generally known as a country which has always been agricultural; we may however more properly term it a "cerealist country".

After the world war, the realisation of the union of all the Roumanian provinces into a single kingdom also brought in Transylvania and Banat, two provinces of appreciable industrial activity, and the idea has become general abroad, and even in Roumania, that Great Roumania will no longer henceforth occupy its former important position in the world's trade in cereals. This opinion, which is very erroneous, as we shall show, is based on the following argument: Transylvania and Banat (the part which has come back to Roumania) are less suitable for cereal cultivation and, on the other hand, are larger consumers of cereals than was the Former Kingdom of Roumania.

These two reasons are the results of an altogether superficial examination of the question, in which, on the one hand, the decrease in the production of cereals in the above-mentioned provinces is exaggerated, and on the other, the increase in the power of consumption of the two provinces.

If the total cereal production of Great Roumania be considered, it must not be forgotten that Bessarabia yields a very appreciable surplus.

The following figures will support this statement:

The production capacity of the chief cereals (wheat, rye, barley, oats and maize) according to the pre-war data, per province, is as follows:

	ha.	tons
Transylvania, Banat, Crisana, Maramures and Bucovina	3 724 000	5 205 000
Bessarabia	2 361 000	2 822 000
Former Kingdom	5 665 000	6 033 000
Total	11 750 000	14 060 000

That is to say, the productive capacity of the vaiious cereals has risen from 6 million tons in the Former Kingdom to 14 million tons in Great Roumania ; consequently it has increased 2.33 times
The increase in total area has been . . . . 2.29 »
That of the population has been . . . . 2.16 »
That of the area under cereals has been . . . . . . 2.07 »
Consequently, as regards cereals, the proportions have remained the same in United Roumania as in pre-war Roumania.

* * *

We have spoken up to the present of productive capacity, and not of production, and have taken the figures of the pre-war yield and not the present figures. The reason for doing so is that Roumania, in this respect, is at present in an abnormal state, and the present figures can only be of very relative value

In fact, after the war, a social-economic revolution has taken place in Roumania, pacific and without any sort of opposition, in which the lands of the large estates have been allotted, under certain conditions, to the peasants, and the large capitalist agricultural enterprises, with large means of all kinds, have thus been transformed into small enterprises, without capital and with primitive means. To this should also be added, besides a number of other factors, a series of years very unfavourable to agriculture, which have not played the least important part in bringing about the present abnormal situation.

Little by little all these unfavourable circumstances will be improved, because the peasant, having become a landowner, but without capital, will gather together the necessary material, will improve his equipment more and more and there will be better management and more scientific livestock breeding, which in turn will appreciably increase his capacity for soil cultivation.

Side by side with this gradual material improvement for the peasant, the progress following on instruction will be seen to penetrate automatically, for the Roumanian peasant is very amenable to instruction and progress.

The author of these lines speaks from experience, having had the opportunity of observing on the spot the admirable results following the settlements in Dobruja of purely Roumanian elements, almost all natives of the Former Kingdom, the Transylvanians

being in the minority and more especially sheep breeders, and a part coming from the southern provinces of Bessarabia, which passed in 1878 to Russia.

The Roumanian Government has not given to the Dobrujan settlers anything but the bare land, and they started work in extremely difficult conditions, for they were without houses, stabling, roads, railways, schools, churches and a great number of other things. Industry was altogether out of the question.

In less than twenty years the soil of Dobruja, considered unfit for cereal cultivation, has become an important grain centre, and the Roumanian villages have visibly increased and become richer; fine schools and churches are springing up here and there, and all this is owing to the sole initiative and means of the villagers themselves.

Similarly it may be concluded as certain that, in a short time Roumania will resume the place it has always held in the world's cereal market. And the country will increase in importance with the extension of its territory, and if we think that the land under cereals in Roumania may be still further considerably increased by the exploitation of the immense territories which can be irrigated along the Danube and at its delta, and add thereto a gradually increased yield (to-day it is below 15 hectolitres per ha., whereas England, Belgium, etc. have a yield of more than 32 hectolitres per ha.), the great development which will take place in the cultivation of cereals in Roumania may be easily imagined.

With regard to certain ideas of transforming this cultivation in Roumania, even supported by Roumanian statesmen, as for instance an increased cultivation of forage crops in view of the increase in stock breeding, the advantages should not be exaggerated, for in any case these changes can only very slightly influence the cultivation of cereals as regards their extension and intensification. The same may be said, without the risk of error, of the recent attempts to introduce the cultivation of cotton.

As regards the extended cultivation of oleaginous plants (rape and flax) and legumes (beans, peas and lentils) an increase in production will naturally take place, but rather slowly; on the other hand, from the commercial point of view, they come within the category of cereals and occupy a similar place on the market.

It has also been proposed, and attempts have even been made, after the war, to industrialise the country more and more, and it

has been thought that that would restrict the cultivation, or rather the exportation, of cereals

This idea must be excluded for a number of years to come, for of the mining industries, among which that of petrol may be more especially mentioned, the only ones capable of rapid development are not of a nature to greatly modify our cereal trade abroad.

At the present juncture of affairs in Roumania, cereals will form the wealth of the country and the preponderating part of foreign trade for a long time yet; it is therefore very natural that the organisation of the cereal trade with a view to promoting cultivation is engaging the serious attention of specialists in Roumania.

In this connection the first question which presents itself, and is of vital importance, is the question of transport.

The absolute lack of suitable railway transport, the railways being all owned and managed by the State, is a great obstacle to the profitable development of cereals in Roumania.

Moreover, the problem of railways is not new in Roumania, for even before the war, their insufficiency strongly reacted on the whole of the national economy of the country, and more especially on the cereal trade. The cause of this was that production and trade developed in geometrical progression, whereas the capacity for transport by rail scarcely followed in arithmetical progression.

Unfortunately this situation has become still worse after the war, for though production and trade have become greatly reduced, the railways, owing to lack of material after the war, have been, so to speak, annihilated. What has been done to improve railway transport is far below what is being done towards reestablishing production and trade. Thus, naturally, the unsatisfactory state continues.

The insufficiency of railways has been acutely felt from the end of the war up to the present time, in spite of the fact that production has considerably decreased and exportation been reduced in consequence.

What will happen when production becomes normal and, consequently, exportation also?

Some figures will enlighten us on this question:

The Former Kingdom exported on an average each year 3 300 000 tons of cereals out of its total production of 6 000 000 tons annually, i. e. 55 % (a proportion only equalled by that of Argentina, all other

countries in the world following well behind), while cereals formed 72 % of the total exports of the country.

Great Roumania, in 1923, exported 1 698 000 tons of cereals out of a total production of 9 745 000 tons, i. e. scarcely 17.5 %, and scarcely 35 % of the total exportation in 1923 (4 878 000 tons).

Taking the normal percentage of exports, namely 55 %, out of the total production of 14 million tons, we should export about 7,700,000 tons yearly.

How shall we transport all that, if it has been so difficult to transport scarcely 1 700 000 tons of cereals per year?

On the Danube, it may be said that things are a little better as regards water transport, though river tonnage was also reduced during the war, and has not yet been made good; at the present time on the Lower Danube there are about 600 000 tons of carrying capacity (lighter tonnage), and before the war this capacity was 942 000 tons; the present tonnage has proportionally even less tractive power than before the war, owing to the lack of tugs.

With such an insufficiency of transport, the necessity of means of warehousing cereals is naturally felt even more, and however great this capacity, it would always be insufficient so long as transport cannot be effected at the proper time.

Between the carrying capacity and warehouse capacity, there is a very close relation: one should aid and complete the other; but to do this with advantage, there must be a true equilibrium between these two factors. Any warehousing depôt system, however ideal, becomes disadvantageous or too expensive, or both, without suitable transport capacity; the investment of capital for bonded warehouses is very great, and, without active movement, cannot bring in any return, but movement without transport capacity cannot exist.

In recent years the Roumanian Government has taken up the question of cereal warehouses very seriously, examining the possibility of introducing the American system, with standardisation, grading and certification. The promoters of this suggestion and those who proposed it to the Government, have based on the principle that the introduction of the American system in Roumania would to a great extent solve the question of facilitating transport, saying that this would take place the same as in America.

The fact of their supporting this idea arises from exaggerating the effects of the system. In America the system has succeeded

owing to the great transport capacity, which has given the system that movement which alone can ensure returns on the capital invested without encumbering production too much with exaggerated storage.

The American systems, as regards constructional and mechanical technique, docks and elevators, have commenced to become general even in Europe, in the centres having an active trade in cereals, irrespective of whether it is a question of exportation, importation, or even of local trade; but the American system, as regards commercial technique, i. e. standardisation, grading and certification, has not been followed anywhere in Europe up to the present, for European conditions are totally different from American. The only thing in the way of trade technique coming from America and kept up in Europe is "warrantage", an operation quite independent of the rest of the system.

Moreover, the system of "warrantage" of cereals exists also in Roumania, has long existed even, in the principal ports where there are also stores with elevators on the American system, at Braila, Galatz and Constanza; but neither has the "warrantage" given the results hoped for in Roumania, because circumstances in our country are quite different from those in America.

Consequently, the present moment would not be suitable to try to introduce the system of American classification of cereals in Roumania, now that the means of transport are so unsatisfactory, and when it cannot be a question of classing trade qualities as formerly, under the large estate system, when each grows "what Providence sends", and Roumanian cereals are traded abroad almost exclusively on the basis of "fair average quality", or at most, on that of "types", i. e. of approximate samples, with a general character, previously established for the whole season.

This however does not mean that the intrinsic value of Roumanian cereals has in any way diminished, for this value is quite independent of the weight per hectolitre and the percentage of offal, which are only related to yield, and consequently form a question of commercial calculation. For instance, Roumanian wheat weighing 75 kg. per hectolitre may give a flour of superior quality to that given by another species of wheat weighing 80 kg. per hectolitre and without extraneous matter.

This, by the way, is still better known abroad than in Roumania, for the Roumanian cereals, light as they are and impure,

hold the first place in foreign ports, in comparison with the heavier and purer cereals from other parts.

Moreover, as regards the introduction of the American system of grading in Roumania, all competent and interested circles, farmers and dealers, are decidedly opposed to it.

It is to be hoped that the Roumanian Governments will inaugurate an economic and fiscal policy more favourable to the cultivation of cereals in the country, the only country which taxes its cereals for export to the extent of 25 to 35 % of their value within the country.

E. M. BRANCOVICI,
Professor at the Higher Commercial and Industrial Academy, Bucharest.

INTERNATIONAL ASSOCIATIONS

PROCEEDINGS OF THE INTERNATIONAL SOCIETY OF SOIL SCIENCE

Papers.

On the question of KCl addition in the case of the electro-metric determination of the soil reaction. II:

CAN THE LIME-REQUIREMENTS OF THE SOIL BE DETERMINED FROM THE REACTION OF SOIL SUSPENSIONS CONTAINING POTASSIUM CHLORIDE?

In the *Internationalen Mitteilungen für Bodenkunde,* Vol. XIV, p. 137, 1924, I showed in collaboration with H. PFEFFER, that the DAIKUHARA method and the determination of the "real acidity' in suspensions containing KCl, in the case of mineral soils, give proportional values, because in such soils the real acidity is a function of the exchanged aluminium.

The comparison of the "titration acidity" of the soil extract in 1 m. of KCl solution with the electro-metric determination of the P_H of the soil suspension in 0.1 m. KCl solution, was undertaken in order to justify the theory of KAPPEN as to the importance of the "exchange acidity" which was attacked at the Rome Soil Science Congress in 1924.

KAPPEN himself and his colleague reject the determination of the exchange acidity by means of physical methods, because the P_H 'does not always fit in' to the correspondence between titrated "exchange-acidity" and growth of the cultivated plants.

Since H. KURSTE for example has measured the P_H in a water suspension, it is not surprising that he reaches the same conclusion as KAPPEN. "Titration-acidity" in KCl soil extracts, and P_H va-

lues in water suspensions are incommessurable quantities. That the P_H values of the suspensions with KCl content actually do fit into the above mentioned relation between acidity and plant growth, has been shown by the author from copious material which was accumulated by means of soil researches carried out on farms in conjunction with practical farmers (2).

To obviate any misunderstanding it may here be once more emphasized that it is the electro-metric determination of the soil reaction that is in question; in colorimetric methods the addition of neutral salts is undoubtedly misleading on account of the likelihood of errors and should be avoided. If the objectors to the addition of KCl take their stand on the fact that the influence of the potassium chloride depends on the soil reaction from the concentration (3), they are overlooking in that connection:

1. that the natural suspension of soil in water is a water suspension only in name, as HAGER (4) has specially pointed out;

2. that onwards from a certain concentration the influence of the KCl is constant (5).

It is obvious that by the use of fertilisers containing potassium salts the concentration of 0.1 m. is not reached. But since it is precisely the very small KCl concentrations which have the most marked effect, and since, in consequence of the experimental method followed, employment of syphons filled with KCl, it is difficult to prevent the diffusion of KCl in the soil suspensions or even to control it, it seems to me to be practicable to select such a concentration (0.1 m KCl) which, on the one side yields constant maximum values and on the other has no marked effect in diminishing salts in the quinhydrone or hydrogen electrode.

My further researches make it possible to advance a step further and in the direction of the determination, or a closer estimate, of the 'lime-requirement' of the soil. If the electro-metric determinations of the soil suspensions on 0.1 m. KCl solution and the "total acidity' determined by titration in 1 m. KCl soil extracts are shown on a system of co-ordinates, a curve results which makes it possible to draw conclusions as to the lime requirements from the hydrogen index; the natural assumption therefore is that the total acidity as determined by the DAIKUHARA method is a measure of the lime requirement of the soil.

Loamy and clayey soils of a varying, but for the most part small, humus content were employed for the comparative experiments.

The P_H determinations were obtained electrometrically on application of the acidimeter, which I have described on a previous occasion (6), to suspensions containing 0.1 m KCl. The "total acidity" was quite independently determined by Dr. UTESCHER and Dr. HALLER according to the DAIKUKARA method.

The following table gives the results of the comparative experiment, which is represented graphically in the diagram in the text:

The relation between P_H and the "total acidity" is shown by a series of curves (fig. 260), in which the curves become flatter as the

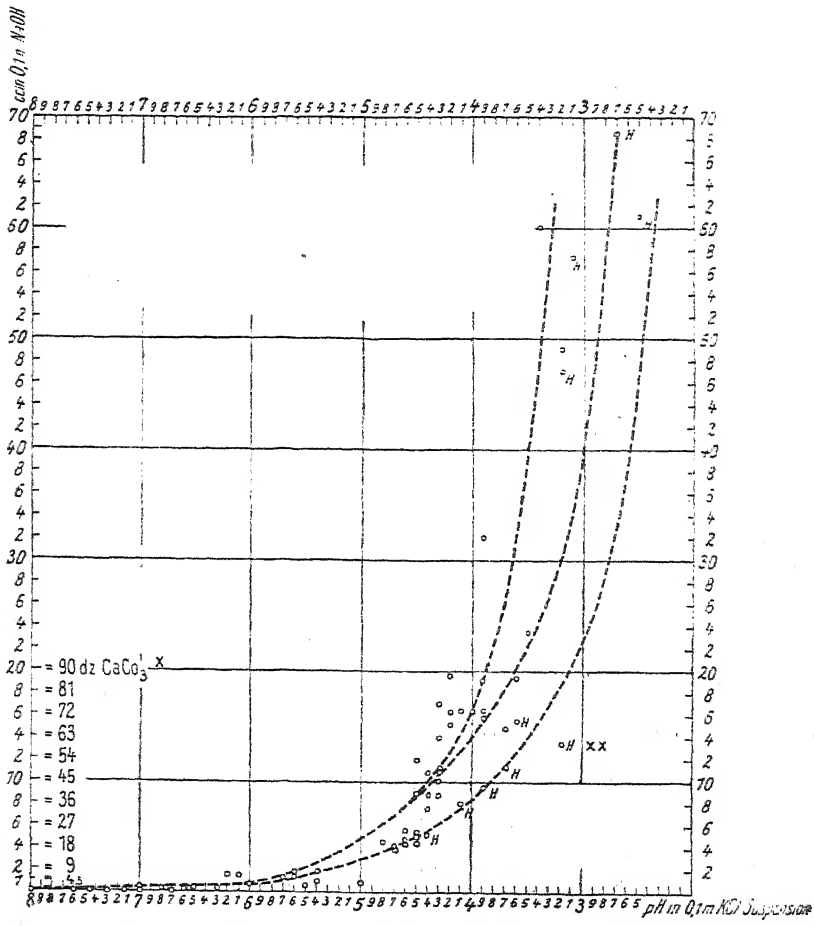


FIG. 260. — The dependence of the lime requirement on the soil reaction.
Explanations : x = Lime requirement per hectare.
xx — H = humus.

TABLE I. — *The Dependence of the Lime Requirement on the Soil Reaction.*

No.	Laboratory number	Actual acidity of the soil suspension PH	Total acidity cc. 0,1 N. NaOH	Remarks
1	9 371	7.3	0.0	
2	8 373	7.0	0.0	
3	9 374	6.4	0.2	
4	9 369	7.15	0.0	
5	9 789	6.55	0.2	
6	9 860	7.45	0.0	Poor soil with 30 % $CaCO_3$.
7	9 861	7.61	0.0	
8	9 939	6.2	1.4	
9	9 940	6.1	1.3	Arable loam soil from the Oder marsh (Gieshof).
10	9 941	5.6	1.8	
11	9 942	5.4	1.5	
12	9 943	5.6	1.4	
13	9 944	5.4	1.9	
14	9 312	4.5	12.0	Sub-soil of forest soil.
15	9 315	4.3	17.2	
16	9 332	6.2	0.6	
17	9 334	6.4	0.4	
18	9 337	4.7	4.0	
19	9 992	6.6	0.0	Loan with 6 % $CaCO_3$.
20	10 019	6.7	0.0	
21	9 989	4.6	5.6	Humus clay.
22	9 990	4.4	10.4	
23	9 991	4.5	9.0	
24	9 993	6.5	0.0	Clay soils 6 % $CaCO_3$.
25	10 028 a	4.4	8.8	
26	(7) 10 028 b	4.8	4.7	Nos. 25-49 are loamy forest soils (7).
27	10 028 c	4.2	19.6	
28	10 029 a	4.3	10.0	
29	10 029 b	4.5	5.2	
30	10 029 c	4.2	16.4	
31	10 030 a	4.0	16.4	
32	10 030 b	4.4	4.4	
33	10 030 c	4.1	16.4	
34	10 031 a	4.0	16.4	
35	10 031 b	4.7	4.0	
36	10 031 c	4.3	14.0	
37	10 032 a	4.3	11.2	
38	10 032 b	4.3	1 .0	
39	10 033 a	4.2	8.0	
40	10 033 b	4.6	4.8	
41	10 033 c	4.2	15.2	
42	10 034 a	4.4	7.6	
43	10 034 b	3.9	19.2	
44	10 035 a	4.3	8.8	
45	10 035 b	4.5	5.2	
46	10 036 a	4.5	4.4	
47	10 036 b	4.5	4.4	
48	10 037 o	3.7	11.8	
49	10 037 b	4.4	5.2	

TABLE I. — *The Dependence of the Lime Requirement on the Soil Reaction.*

No.	Laboratory number	Actual acidity of the soil suspension P_H	Total acidity cc. 0.1 N. NaOH	Remarks
50	10 040	3.9	9 6	
51	10 041	3.2	14.4	
52	9 493	3.5	23.2	
53	9 436	3.6	19.4	
54	T 3	3.9	32.0	Tropical primitive forest soil.
55	9 429	3.2	57.2	Humous forest soil.
56	9 845	3.4	60.0	
57	9 635	3.6	15.6	Humous forest soil.
58	9 428	3.1	47.6	Humous forest soil.
59	9 712	5.0	0.8	
60	9 710	5.5	0.6	
61	9 432	5.7	1.2	
62	9 471	8.0	0.0	
63	9 799	3.7	14.4	
64	9 418	2.5	61.0	
65	9 419	2.7	68.4	
66	10 000	6.75	0.2	Loamy mould.
67	10 001	7.0	0.3	Subsoil at depth of 1 m.
68	10 002	6.0	0.7	Subsoil at depth of 2.2 m.
69	10 003	7.05	0.3	Subsoil at depth of 3.5 m.
70	10 025	6.5	0.4	
71	10 026	6.3	0.4	
72	10 027	6.8	0.2	
73	10 028	6.6	0.2	
74	10 029	6.5	0.2	

content of humus increases: the divergence is not great up to P_H 4.5. Since soils the reaction of which is more acid than P_H 4.5 are on the whole of rare occurrence, the steeper curve practically serves to determine the lime requirement from the quickly ascertainable value in P_H. In the case of obviously humous soils the flatter curve will be suitable for the purpose.

The lime requirement in kg. $CaCO_3$ on 1 hectare (3 million kg.) is reckoned according to the formula: $a \times 3 \times 1.5$ in which a is the titration liquid reckoned in cm. on 100 gm. soil. These figures hold for heavy soils: for medium soils the value should be estimated at about half and for sandy soils at one-third.

As the series of curves approaches the co-ordinates as asymptotes, the questions may be put: What lime requirement has a soil which is in the first place neutral, and in the second more acid than P_H 4.0? In both cases the curve seems to give no answer.

To this it may be replied: in the case of neutral soils the DAIKUHARA method must necessarily fail: a highly probable case is that in which a soil containing no chalk is agitated with KCL solution and shows no acidity that is capable of titration. In such cases other methods must be employed.

In the case of very acid soils the quantities of lime estimated as required according to DAIKUHARA are so large that it becomes impossible on practical grounds to supply the lime deficiency by a single liming.

From the above considerations the following conclusions seem able to be drawn:

1. If the soil is neutral, the lime content of the soil is to be tested either by analytical or geological methods, and accordingly a minimum dose given, the amount of which is to be determined empirically.

2. In the case of slightly acid soils the lime requirement can be determined approximately from the given series of curves; with markedly humous soils the flatter curve is employed for the purpose (8).

3. With soils that are more acid than P_H 4.0, the first thing to do is do apply the quantity of lime which is practically possible; after a certain time to ascertain the result by renewed testing and to make any further liming depend on these tests.

I wish here to thank Prof. Dr. SCHUCHT, Prof. GANSSEN and Dr. HELMERS for the valuable suggestions they have made.

SUMMARY.

In completion of earlier investigations in regard to the dependence of the P_H, from the "total acidity", the attempt is made to infer the lime requirement of the soil from the P_H determination of the soil suspension in 0.1 m. KCl solution. The dependence of the lime requirement on the P_H is graphically represented: the curve of the humous soils is clearly distinguishable from that of the pure mineral soils and gives for humous soils a lower lime requirement than for mineral soils.

MAX TRÉNEL,
The Geological Institute, Berlin.

NOTES AND BIBLIOGRAPHY.

(1) *Zeitschr. für Pflanzenernährung und Düngung.* Year 4, pp. 159-171 ; cf. also Year 5, pp. 193 and seqq. (1925).

(2) M. TRÉNEL, " Hat die Bodenreaktion auch in der praktischen Landwirtschaft den Einfluss, der ihr auf Grund von wissenschaftlichen Vegetationsversuchen zugeschrieben wird ? *Zeitschrift für Pflanzenernährung und Düngung.* Year 5, Part 4. 1925.

(3) O. ARRHENIUS, Die Einwirkung neutraler Salze auf die Bodenreaktion. *Mitt. der Intern. Bodenkundl. Gesellschaft,* I, p. 28. 1925.

(4) HAGER, *Zeitschrift f. Pflanzenern. und Düngung,* Year 4, pp. 159-171, 1925.

(5) E. M. CROWTHER, Studies on Soil reaction. *Journal Agric. Sc.* 15, pp. 201-221.

(6) M. TRÉNEL. *Intern. Ges. für Bodenkunde* XIV, Part 1, 2. 1924.

(7) The soils marked *a* are drawn from humous mould ; those marked with *b* and *c* come from the subsoil.

(8) Th. ARNDT. *Zeitschrift f. Pflanz. u. Düngung.* Section Year 4, pp. 55-72. ARNDT states that the DAIKUHARA method gives too high a value for marshland soils.

TO WHAT EXTENT IS THE LIME CONTENT AND REACTION OF A SOIL RELATED TO THE MANNER OF ITS FORMATION ?

The controversy as to how far we are justified in drawing conclusions as to the chemical and mechanical properties of a soil from the geological character of its subsoil, is as old as the science of agriculture itself. There were also two schools of thought as to the estimation of the lime-content of a soil from the character of the underlying matrix. One school believed in its general application, while the other denied it by putting forward generalisations which applied only to large areas.

From a geological standpoint, the principal objection which can be put forward against the derivation of the carbonate of lime content of a soil from its geological relation to the underlying matrix, is that, although this may be true in the case of primary soils, especially when the length of the weathering action on them is known, they occur in much smaller numbers than secondary soils. The above statement is also true, if we leave out of account, in the case of a large number of primary soils, the influence of climatic changes which have taken place, up to most recent times.

Agricultural science was able to prove in the course of the last decade (1) that starting with the same rock, different climatic conditions produce quite different soils, and that the following rule applies : in dry soils the bases remain, in humid soils they are washed out.

In the humid climatic regions therefore, all primary soils must either be deficient or get deficient in bases, or looking on it from a colloid-chemical point of view, they are, or are getting in, an absorptive-unsaturated state, i. e. either have an acid reaction or are passing into acidity.

However, even a considerable number of secondary soils have been and still are undergoing an impoverishment in bases.

The base content of a soil is determined on the one hand by the base content of the original rocks, from which it was formed, and on the other hand by the time during which the varying climatic factors have been changing over the same region (2). But this statement loses considerably in its general applicability on

account of the far-reaching climatic changes which have taken place over the whole of our region during the diluvium, and the events since then. The upper layers of the primary soils in the humid climatic zone consist now of the further sub-aerial developments of the then (in diluvium) existing soils, together with the aeolithic and fluvial deposits of the ice-age. Equalising influences caused the prevalence, in this zone, of the brown-earth type, but it must be remembered that the duration of these influences is still too short to produce a chemically homogenous type of soil, especially in countries like Bavaria, where the multiplicity of the geological strata and the multiformity of the orographic arrangements and of their relations on a limited space is so very great. The equalising factors are influenced to a great extent by the mechanical composition of the soil.

In considering the strata, which, when looked upon from an agricultural and forestry point of view, we call soil, we must, among other factors, take account of the influence of plants and animals on it, and must also not forget the influence exerted by man through ploughing, manuring and choice of plants. Correspondingly, the deficiency of a soil in bases, will differ according as it is covered by plants, and it will depend on the kind of plant, whether its physical character will allow the earth-worm to exert its full action, and according as man by his ploughing mixes the layers of subsoil richer in bases, with the poorer upper layers, and according as he adds, through manuring, substances rich in bases, base-fixing or base-liberating.

The last mentioned point, of the chemical changes produced by manuring in the soil, has attracted the special attention of agricultural chemists in the last decade.

Fundamental researches, as *e.g.* those of R. GANS (3), explained the influence of different kinds of weathering on the molecular composition of the zeolithic silicates, and thus gave valuable insight into the nature of the reactions taking place in a soil. They showed that in considering the zeolithic silicates of the soil, decomposable by hydrochloric acid — the aluminium silicates — as chemical compounds, that a soil should be called *neutral*, whose zeolithic silicates are so composed that to each 3 mols. of SiO_2 and 1 mol. Al_2O_3 they contain 1 mol. of a base (CaO, MgO, K_2O, Na_2O), and those are to be considered *acidic* which contain to every 3 or more mols. of SiO_2 less than 1 mol. of a base, and if to every 3 mols.

SiO_2 there are more than 1 mol. $Al\ O_2$, they are to be considered *basic*.

On the results of these investigations were assumed to be based the numerous investigations on the chemical reactions taking place in agricultural soils, whose principal object was the elucidation of the changes produced in those soils by manuring. In all these investigations we are dealing with an object with a definite geological history, and that history left its mark on its chemical character and behaviour; and many a generalisation injurious to the science of manuring was retained in this way.

The use of artificial manures does not go far back, and in the case of Bavaria, certainly not more than a few decades, and the amounts used even now are comparatively small, and some soils did not get any artificial manuring until very recent times. They have in many cases a typical and very often an acid reaction. This may refer to heavy soils. On the other hand, there is at this Institute a large number of unfinished investigations on test-field loamy-soils, which have been receiving considerable amounts of chemically and physiologically acid manures for a number of years and which even now still show their unchanged original reaction. Thus, we have on the one side soils as. *e.g.*, the majority of sandy-soils poor in bases and many loamy-soils, which on addition of large amounts of chlorine-containing or physiologically acid-neutral salts begin to show an acid reaction, which makes them unsuitable for the economic growth of plants, but on the other side we have soils which on account of their geologically based physical and chemical constitution, not only favour prolonged acid manuring, without addition of bases, but even require it. In other words, when considering the chemical reactions of a soil the geological and agricultural aspects must not be omitted. True, in this way many a generalisation in manure-technique would have been missed, but on the other hand many geological and agricultural scientific experiences would have been gained, which would have formed a starting point for many generalisations which, though applicable only within certain limits, could yet be extended from single experimental results to all the geologically similar soils.

These general observations apply to a comparatively large number of systematic investigations on the reactions and lime-requirements of most Bavarian soils, carried out at this Institute for agricultural chemistry, since 1923, after many years of prepar-

atory work. In the following pages it will be attempted to give account of certain of the results obtained, but before doing this, is will be useful to give an account of the procedure of the investigation, from the taking of the soil-sample up to the investigation proper (4).

The party chosen for supplying a soil-sample, for lime-requirement and chemical investigation, receives together with a guide as to the way the sample should be taken, also a questionnaire. The questions are put not only from a manure technical and plant-organisational point of view, but also from a geological and agricultural scientific point of view. The completed questionnaires are returned simultaneously with the soil-samples. Already first experiences have shown that large and small farmers alike answered the different questions very unreliably, and although, no doubt, the answers received do give some information, yet for statistical purposes even, quite disregarding scientific purposes, the material can be used only with great care, if at all. We therefore sought the collaboration of the Bavarian agricultural advisers, and in the course of the first year we managed to interest in our work 42 agricultural stations (5), to supply us with soil-samples for investigation and in most cases, to answer our questionnaire for each soil sample separately. Also in this case it was soon found that on the average the answers are suitable only for drawing of statistical conclusions, but only in few cases are they suitable for scientific use. In most cases special stress is laid on the manuring and plant-organisation answers, for quite obvious reasons, while the agricultural-scientific answers are unsatisfactory. It may be that the unsatisfactoriness of the geological and scientific-agricultural answers is due to the fact that they are given by men expecting immediate practical results, or it may be due no doubt in many cases, to the ignorance of the soil-forming factors and of the disposition of the secondary geological strata, which ignorance cannot be dispelled because of the lack of suitable 1 : 25,000 maps.

After this was recognised, the reporter (F. V.) himself attempted to obtain, with the help of good geological maps, typical soil-samples from different parts of Bavaria, so as to get the necessary scientific basis for the conclusions drawn.

In this way only could the suspicion of a close relationship between the chemical character of a soil and its geological mode

of origin be confirmed. These observations will be given in the following pages.

Each sample received was registered, separated according to the size of its particles, and had to undergo a preliminary investigation by different quantitative methods (6). These preliminary investigations were carried out to gain information as to the general character of the chemical reactions of the sample. Next followed the measurement of its hydrogen-ion concentration, the institution of the nitrogen bacteria test, and, if necessary, the determination of its titrational acidity.

In the statistical treatment of the 2255 soil-samples received from September 1st 1923 till August 31st 1924 (7), after their arrangement in different reaction stages — according to the hydrogen-ion concentrations, P^H, as determined in KCl extract — the following were the results:

TABLE I.

P^H reaction	No. of soils	% of the total
Below 4.5	283	12.55
4.5 — 5.0	263	11.68
5.01 — 5.6	175	7.67
5.61 — 6.2	410	11.18
6.21 — 6.7	342	15.16
6.71 — 7.0	281	12.46
Above 7.0	501	22.21

According to this, if we consider only the hydrogen-ion concentrations as measured in a KCl extract, more than half of all soils investigated (P^H below 4.5 up to P^H 6.2) namely 50.17 % may be regarded as physiologically acid, 15.16 % (P^H, 6.21-6.7) as neutral and 34.67 % (P^H 6.71 – over 7.0) as alkaline. Almost all soils with a P^H below 6.2 and a number of those with a P^H of 6.2 – 6.7 must on the results of other different investigations be regarded as deficient in lime. The great majority of soils of P^H 6.2 must be considered as absorptively – unsaturated.

The unexpectedly large number of Bavarian soils found to be acid and deficient in lime, caused us to investigate their relation to the different geological formations found in the country. This appeared necessary in view of the multiformity of the Bavarian

geology, if a general conclusion is going to be drawn, applicable to all the other numerous Bavarian soils, which, to form a final opinion, still required investigation, and if a conclusion is going to be drawn as to the distribution of the lime-deficient and non-deficient soils under investigation.

Investigations were therefore undertaken to determine the geological character of the different soils. For this purpose use was made of samples of soils taken from the Institute itself, and of samples of soils sent in, in exceptional cases, with satisfactorily answered questionnaires. These samples, well known, were then united into definite geological and scientific-agricultural groups. It was thus possible, *e.g.*, to separate out distinct groups from the large number of secondary groups forming a soil-group in a given formation, and this was possible in the case of lower-terrace loamy soils, upper-terrace loamy soils, certain diluvial loamy soils of Franconia, and Keuper-sand soils. It is thus proved that the large number of soils grouped under the name " general diluvium " contain a whole series of terrace, gravel and moraine soils, that the group " Keuper general " contains a large number of other soils, *e, g.*, upper " Bunter Keuper ", uppergy psum " Keuper ", etc. The lack of more definite information as to the exact place from which the soil has been taken, or of the proper geological section (profile), caused us, in concluding about each soil, to place it more in agreement with the upper members of a formation than with the lower ones. Thus, while the diversity of the soil material, well known in its geological particulars, diminished considerably, the number of sub-divisions of the larger geological formations increased considerably.

After this preliminary segregaton of the different formations, each soil of each group was entered in a definite column in a table according to the results obtained in the hydrogen-ion concentration determination, total acidity and lime requirement determinations. In the case of a considerable number of soils they could not be placed in any definite geological formation and all those were combined, and entered in a column as " Soils with no definite character " (geological). In this way Table II was obtained.

TABLE II. — *The geological character of the soils investigated, in their relation*

Geological character of the soils	Number of Samples	Reaction Groups (pH) under 3.5		3.51–4.0		4.01–4.5		4.51–5.0		5.01–5.5		5.59–6.0		6.01–6.5	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
General *alluvium*	58	—	—	—	—	1	1.7	2	3.5	2	3.5	1	1.7	4	6.9
(*a*) Garden soils	67	—	—	—	—	1	1.5	3	4.5	5	7.5	7	10.4	14	20.9
(*b*) River soils	21	—	—	—	—	1	5	1	5	1	5	1	5	3	14
General *diluvium*	610	—	—	—	—	21	3.5	52	8.5	41	6.7	98	16.0	143	23.5
(*a*) Diluvial loams	44	—	—	—	—	—	—	3	6.8	5	11.4	21	47.7	9	20.4
(*b*) Diluvial loams over Miocene	17	—	—	—	—	1	—	3	—	1	—	5	—	1	[illegible]
(*c*) Loess	20	—	—	—	—	—	—	—	—	—	—	—	—	1	5
(*d*) Loess loams	33	—	—	—	—	—	—	—	—	—	—	6	17	5	16
(*e*) Diluvial sands	10	—	—	—	—	1	—	2	—	1	—	1	—	2	—
(*f*) Recent morain gravel soils.	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
(*g*) Loam over high-terraces	31	—	—	—	—	1	3.2	10	32.2	4	12.9	10	32.2	5	16.1
(*h*) Loam over low-terraces	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
(*i*) Soils of recent valley-terraces	6	—	—	—	—	—	—	—	—	—	—	—	—	—	—
(*h*) High-moor soils. . . .	9	1	—	1	—	1	—	1	—	1	—	—	—	4	—
(*l*) Low-moor soils	21	—	—	—	—	—	—	—	—	—	—	5	24	2	10
General *Tertiary*	77	—	—	—	—	2	2.6	7	9.0	3	3.9	14	18.2	16	20.8
(*a*) Tertiary sands	20	—	—	—	—	—	—	1	5	1	5	3	15	4	20
(*b*) Flysch of the lower Alps	5	—	—	—	—	—	—	—	—	—	—	—	—	—	—
(*c*) Brackish-molasse . . .	3	—	—	—	—	1	—	1	—	—	—	—	—	—	—
(*d*) Miocene fresh-water lime	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
General *Cretaceous*	4	—	—	—	—	—	—	1	—	—	—	3	—	—	—
(*a*) Lower chalk	7	—	—	—	—	—	—	—	—	—	—	—	—	—	—
General *Jurassic*	49	—	—	—	—	—	—	—	—	—	—	—	—	4	8
(*a*) Middle Oölite.	22	—	—	—	—	—	—	—	—	—	—	—	—	5	23
(*b*) Lower Oölite (dogger) .	11	—	—	—	—	—	—	—	—	—	—	—	—	2	—
(*c*) Lower Oölitic iron sandstone	8	—	—	—	—	—	—	—	—	—	—	3	—	—	—
(*d*) Liass	45	—	—	—	—	—	—	—	—	—	—	—	—	7	16
(*e*) Alp-covering loams. . .	84	—	—	—	—	11	13.1	6	7.1	6	7.1	20	23.9	32	38.1

to the hydrogen-ion concentration, total acidity and lime requirements (See over).

						Total acidity (Daikuhara) in 100 gms. of fine soil								Lime requirements					
6.51–7.0		7.01–7.5		7.5 and over		above 15 cm.		5.1 to 15.0 cm.		5.0 cm.		none		absolute		conditional		none	
No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
21	36.2	24	41.3	3	5.2	—	—	1	2	3	5	54	93	4	7	2	3	52	90
21	31.3	15	22.3	1	1.5	—	—	1	1	9	14	57	85	9	13	6	10	52	77
4	19	9	42	1	5	1	5	—	—	2	10	18	18	3	14	1	5	17	81
145	23.8	105	17.2	5	0.8	5	1	11	2	192	31	402	66	139	23	136	22	335	55
5	11.4	1	2.3	—	—	—	—	—	—	30	68	14	32	15	34	23	52	6	14
6	—	—	—	—	—	1	—	—	—	6	—	10	—	5	—	6	—	6	—
6	30	10	50	3	15	—	—	—	—	—	—	20	100	—	—	1	5	19	95
20	61	2	6	—	—	—	—	—	—	6	18	27	82	3	9	5	15	25	76
3	—	—	—	—	—	—	—	—	—	3	—	7	—	—	—	7	—	3	—
3	—	—	—	2	—	—	—	—	—	—	—	5	—	—	—	2	—	3	—
1	3.2	—	—	—	—	—	—	—	—	22	71	9	29	17	55	10	32	4	13
—	—	4	—	1	—	—	—	—	—	—	—	5	—	—	—	—	—	5	—
—	—	6	—	—	—	—	—	—	—	—	—	6	—	—	—	—	—	6	—
—	—	—	—	—	—	—	—	—	—	7	—	2	—	5	—	4	—	—	—
11	52	3	14	—	—	—	—	—	—	5	24	16	76	—	—	5	24	16	76
12	15.6	14	18.1	9	11.7	1	1	1	1	27	36	48	62	14	18	20	26	43	56
5	25	3	15	3	15	—	—	—	—	2	10	18	90	3	15	5	25	12	60
1	—	4	—	—	—	—	—	—	—	—	—	5	—	—	—	—	—	5	—
1	—	—	—	—	—	—	—	—	—	2	—	1	—	2	—	—	—	1	—
1	—	2	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	3	—
—	—	—	—	—	—	—	—	—	—	4	—	—	—	1	—	3	—	—	—
7	—	—	—	—	—	—	—	—	—	—	—	7	—	—	—	—	—	7	—
15	31	29	59	1	2	—	—	—	—	1	2	48	98	—	—	2	4	47	96
9	41	8	36	—	—	—	—	—	—	—	—	22	100	—	—	—	—	22	100
7	—	1	—	1	—	—	—	—	—	—	—	11	—	—	—	—	—	11	—
4	—	1	—	—	—	—	—	—	—	—	—	8	—	—	—	2	—	6	—
15	33	22	49	1	2	—	—	—	—	1	2	44	98	—	—	1	2	44	90
9	10.7	—	—	—	—	12	14	7	8	15	18	50	60	30	36	36	43	18	21

TABLE II. —

Geological character of the soils	Number of Samples	Reaction Groups (PH) under 3.5		3.51–4.0		4.01–4.5		4.51–5.0		5.01–5.5		5.51–6.0		6.01–6 5	
		No.	%	No.	%	No.	%	No.	%	No.	%	No	%	No.	%
General *Keuper*	35	—	—	—	—	3	9	5	14	2	6	4	11	6	17
(a) Alpine Keuperhät . . .	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
(b) Rhaetic yellow Keuper.	4	—	—	—	—	—	—	—	—	—	—	1	—	3	—
(c) Upper red Keupperlett.	12	—	—	—	—	—	—	—	—	—	—	—	—	3	—
(d) Stuben and Burg sandstone	40	—	—	2	5.0	3	7.5	4	10.0	2	5.0	11	27.5	13	32.5
(e) Blasen and Platten sandstone	80	—	—	—	—	2	2.5	16	200	15	18.8	22	27.5	14	17.5
(f) Upper gypsum Keuper.	26	—	—	—	—	—	—	—	—	3	12	4	15	6	23
(g) Schilf sandstone	8	—	—	—	—	2	—	—	—	—	—	2	—	3	—
(h) Lower gypsum Keuper.	12	—	—	—	—	—	—	—	—	—	—	—	—	1	—
(i) Lower Keuper (letten) sandstone	16	—	—	—	—	—	—	—	—	—	—	2	—	2	—
General *Muschelkalk*	21	—	—	—	—	—	—	—	—	—	—	1	5	4	19
General *Bunter sandstone* . .	3	—	—	—	—	—	—	1	—	—	—	1	—	—	—
Northerly upper Franconian Palaeozoic with older igneous rocks	37	—	—	1	2.7	12	32.4	12	32.4	5	13.5	5	03.5	[illegible]	3.7
Recent igneous rocks	2	—	—	—	—	—	—	2	—	—	—	—	—	—	—
General *Primary rocks*. . . .	280	—	—	30	10.8	91	32.6	94	33.5	27	9.6	21	7.5	14	5.0
(a) Granite	25	—	—	—	—	5	20	11	44	7	28	1	4	—	—
(b) Gneiss and Glimmerschiefer	15	—	—	—	—	—	—	4	—	2	—	4	—	5	—
Soils from manure experiments	12	—	—	—	—	—	—	—	—	—	—	1	—	3	—
Soils with no definite	225	—	—	1	0.4	10	4.5	23	10.2	7	3.2	26	11.5	40	17.7
geological character	106	—		—		5		11		3		12		19	
	2,225	1	0.04	35	1.62	175	7.91	276	12.33	144	6.56	316	14.14	400	17.73

6.51–7.0		7.01–7.5		7.5 and over		Total acidity (Daikuhara) in 100 gms. of fine soil: above 15 cm.		5.1 to 15.0 cm.		5.0 cm.		none		Lime requirements: absolute		conditional		none	
No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
11	31	3	9	1	3	1	3	1	3	12	34	21	60	9	26	7	20	19	54
—	—	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—
—	—	—	—	—	—	—	—	—	—	1	—	3	—	—	—	3	—	1	—
5	—	1	—	3	—	—	—	—	—	2	—	10	—	—	—	2	—	10	—
5	12.5	—	—	—	—	3	7.5	2	5	3	7.5	32	80	12	30	15	37.5	13	32.6
9	11.2	2	2.5	—	—	2	2.5	2	2.5	43	54	33	41	35	44	33	41	12	15
10	38	3	12	—	—	—	—	—	—	8	31	18	69	5	19	6	23	15	58
1	—	—	—	—	—	—	—	2	—	—	—	6	—	2	—	5	—	1	—
4	—	7	—	—	—	—	—	—	—	—	—	12	—	—	—	1	—	11	—
6	—	6	—	—	—	—	—	—	—	2	—	14	—	1	—	1	—	14	—
7	33	8	38	1	5	—	—	—	—	2	10	19	90	1	—	2	10	19	90
—	—	1	—	—	—	—	—	—	—	2	—	1	—	1	—	1	—	1	—
1	2.7	—	—	—	—	5	14	7	19	19	51	6	16	30	81	4	11	3	8
—	—	—	—	—	—	2	—	—	—	—	—	—	—	2	—	—	—	—	—
3	1.0	—	—	—	—	80	29	68	24	114	41	18	6	246	88	20	7	14	5
1	4	—	—	—	—	2	8	2	8	21	84	—	—	20	80	5	20	—	—
—	—	—	—	—	—	—	—	—	—	6	—	9	—	3	—	10	—	2	—
6	—	1	—	1	—	—	—	—	—	2	—	10	—	—	—	4	—	8	—
53 25	23.6	60 28	26.6	5 3	2.3	22	10	13	6	51	22	139	62	81	36	45	20	99	44
479	21.17	384	16.56	45	1.95	—	—	—	—	—	—	—	—	—	—	—	—	—	—

The results show that, the number of soils which can be definitely grouped as a geological unit is very large, when compared with the few less known soils of secondary members of those units. This strikes one especially in the case of diluvium where we notice 610 completely known soils and only 201 soils with single separation.

The following considerations apply to the numbers on the left side of the table.

It is especially important to notice and to remember the series of numbers given under the heading "The total number of investigated soils." This shows a slow rise up to P^H 5.0, then a distinct decrease (8), then again a rise up to P^H 7.0, and again a decrease.

If we compare with this the numbers in the column "Soils with no definite character", we see something very similar. From these and other investigated series of soils the following may be concluded, *that a considerable number of investigated Bavarian soils are neutral to weak acids, and acid to strong acids and that only about a third of them are alkaline to strongly alkaline.* Comparing with these two series of numbers those in the columns "general diluvium", "general alluvium", "general tertiary" and "general Keuper", and taking into account only relative numbers we notice *a fair similarity* between all of them.

These relations can be well illustrated by curves (9). In the curve-table shown in fig. 26I the abcissae represent the steps of P^H, while the ordinate represents the percentage of soils of "The total of all soils" (curve *a*), "soil without definite geological character" (*b*), "genneral diluvium (*c*), "general Keuper" (*d*), "general primary rocks" (*e*), recurring in each P^H group. The very nearly parallel character of these curves is unmistakable. *From this we may derive the following rule that, the fact of a soil belonging to a certain geological formation, e.g.* "diluvium", "Keuper", "alluvium" "*indicates nothing else but our ignorance of that soil. An exception is the weathering soils of primary rocks represented in our curve table* (fig. 262).

These soils coming principally from the Bavarian forests and from the Fichtelgebirge are principally weathering products of granite and gneiss, and partly of rocks yielding as their weathering products syenite, diorite, diabase and other lime containing substances. The curve shows in any case that the majority of soils derived from primary rocks are acid and only a small number of them is neutral or weakly alkaline (10).

With these series of numbers of only generally geologically known soils, were compared those of soils belonging to secondary members of formations. What strikes one looking at the table, is the comparatively small number (total) of those soils known.

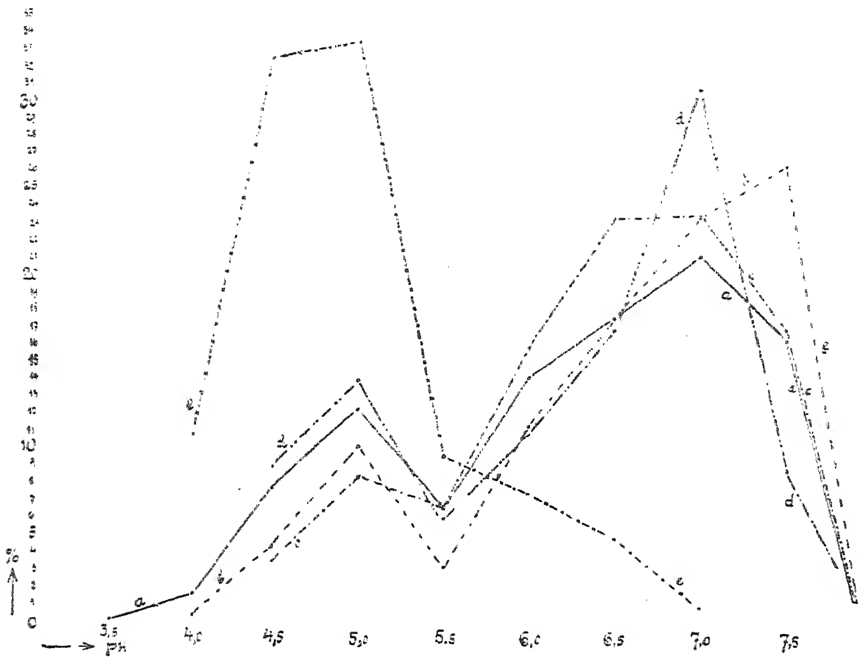


FIG. 261. — Curve-Table I.

a = ———— Total for all soils.
b = - - - - - - - Soils with no definite geological character.
c = — · — · — · Soils of general diluvium.
d = — ·· — ·· — ·· Soils of general Keuper.
e = —×—×—× Soils of general primary rocks.

In a few cases as, *e.g.*, in the case of "low-terrace soils", "newer valley-terrace soils", "brackish molasse", "miocene fresh-water lime", "lower and upper gypsum keuper" and many other series, the number is at first so very small that they do not indicate anything at all. In other cases, on the other hand, there is a definite tendancy noticeable, the number-series become shorter and closer and are limited only to a certain quite definite and

typical P^{H} region, similar to the case of "general primary rocks".

Several of these typical series of numbers are represented in

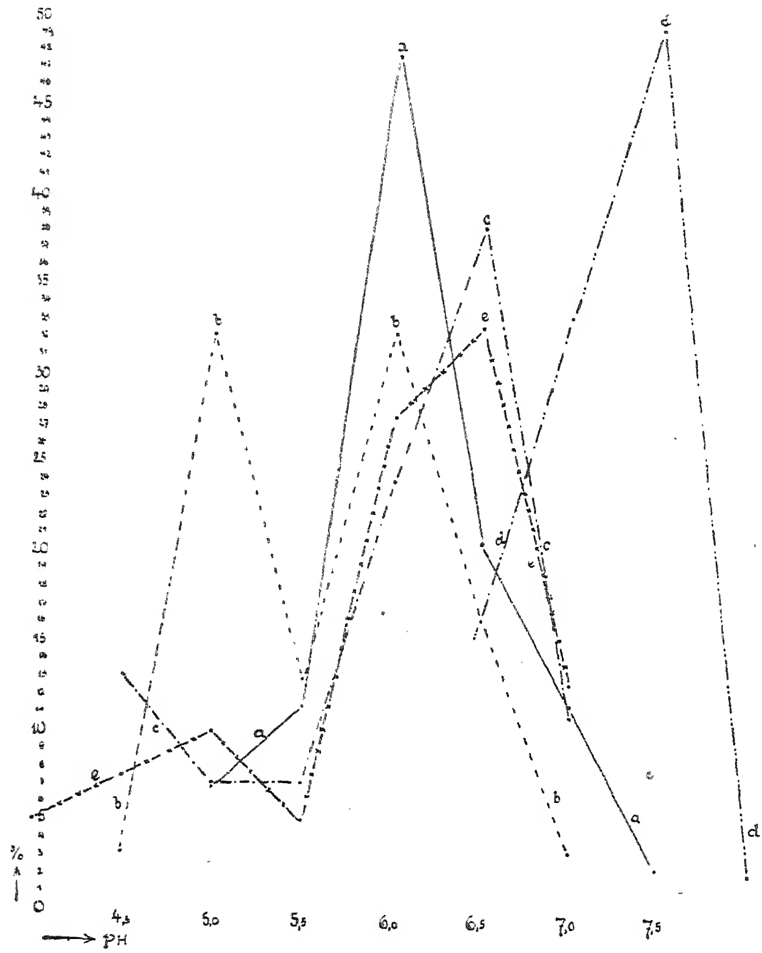


FIG. 262. — Curve-Table II.

a = ———————— Franconian diluvial soils.

b = - - - - - - - Soils of high-terrace loam.

c = — · — · — · Alpine pasture soils.

d = — ·· — ·· — ·· Liass soils.

e = —×—×—× Blasen and Platten sandstone soils.

curve-table II. Only the most numerous soil-series were represented: "diluvium soils in Franconia" (a), "high terrace loams"

(*b*), " Alpine pasture soils " (*c*), " Liass " (*d*) and " Blasen and Platten sandstone " (*e*). True, the curves in the case of the " alb-covering soils ", which are only slightly homogenous, and in the case of the diluvial soils coming from different parts of south-middle Franconia, and in the case of the partly meadow and partly arable loam soils of the Bavarian upper-terrace still extend over a considerable area, yet in distinction to the curves in curve-table I, show a rapid rise and a typical culmination.

Leaving out of consideration the error due to carbonic acid, the following can be said:

The *Franconian diluvial soils* extend over the range for P^H 4.51-7.0, with a culmination at P^H 5.51-6.0. The sloping branch on the alkaline side of the curve would in the case of a largern umber of soils be steeper and come to an end between P^H 6.5-7.0.

The *high-terrace loany soils* lie between P^H 4.01-4.5 and 6.51-7.0 with an apparent double culmination at P^H between 4.51 and 6.0. Also in this case we should get a steeper curve on the alkaline side, if dealing with a larger number of soils.

The *Alpine pasture soils* lie between P^H 4.01-7.0. The culminating point of the curve is between P^H 6.01-6.5. The left acid branch of the curve seems to be greatly influenced by carbonic acid (see note 8). The point of origin of the curve should really have been on the abcissae between P^H 4.5 and P^H 5.0.

The character of the curve for " the Liass soils ", in the right of the co-ordination system, should correspond very nearly with the actual facts, although a larger number of soils would probably cause a narrowing to the right.

The fairly large P^H region between 4.01-7.5 is occupied by the *Blasen and Platten sandstone soils* with their maximum value at P^H 5.51-6.0. It may be that in the case of these sandy-soils as in the case of most of such geological soils their rather wide P^H region may represent also the effects of manuring, for it is a fact that farmers on sandy soils use much more artificial manure than farmers on loamy soils, and moreover slight amounts of manure have a considerable effect in a chemical sense, on sandy-soils.

In segregating the different series of geologically similarly stratified soils it is not only important to take account of the manuring, and it must be pointed out not only that of light soils, but also to a less extent also that of heavier soils, and also the mode of cultivation in connection with its usage. It is quite probable

that the considerable distribution within wide P^{E} regions, which is evident on the curve-table II, is due to the different use of the soils there shown. Already R. GANS (11) believed it to be probable that the non ploughed soils, *e.g.* pasture-land, passes sooner into a state of absorptive-unsaturation, than those soils where ploughing produces an intermixing of the upper layers, poorer in bases, with the lower ones which are richer in bases. That in this way a constant bringing upwards of the bases takes place, i. e., a kind of renewal may be true, although it still requires proving in the case of certain kinds of soils, as could be done in the case of the upper-Bavarian arable and pasture lands.

It should be pointed out that in considering fig. 262, it must be remembered that though every possible precaution was taken to investigate qualitatively each soil as to its mechanical agreement with geologically similar soils, it is possible that several geologically not quite similar soils were placed together, which, although showing the same or very nearly the same geological origin, differ, however, in the size of their particles.

These differences are in many cases caused by differences of slope, as was described by W. KOEHNE and H. NIKLAS (12) and which is of primary importance in the separation of the different classes of soils.

The weathering, progressing as it does, in the direction of slope, and which constantly exposes fresh amounts of base, together with the washing action of water and the deflating and accumulating action taking place more particularly on slopes, must be considered as very important factors in determining the size of the particles, and by this means influencing the reactions of the soil.

Important results are obtained not only from microscopic rock analysis but also from soil analysis.

Equipped with those methods of investigation we had, in several cases as *e.g.* in the case of the heterogenous covering soils and in the case of the partly loamy and partly sandy Franconian diluvial soils, to undertake yet another separation.

In our opinion, *such a procedure would enable scientific conclusions to be drawn as to the relation between the lime-content and reaction-character of a soil and its geological mode of origin, or its underlying matrix, and also with the help of advanced cartography of scale* 1 : 25,000 *or* 1 : 5 000 *and reaction analyses, to apply the conclusions arrived at to geologically and agriculturally similar soils.*

There is no doubt that taking all necessary precautions in forming general conclusions, it would then be possible to indicate practical lines along which further manuring should take place (13).

From further work, carried out since September 1924, on the reaction character of Bavarian soils, the following may be concluded that the *true Alp-covering soils*, which are recognised only with difficulty by many, on account of their showing all transition stages of the weathering products of Franconian dolomite and of other Jurassic members — *are typically deficient in lime and are of neutral mostly of acidic character, and that the poverty of the clover, Mazagan vetch and especially of lucerne is due to this deficiency. They contrast very strongly in this respect with the different Jurassic weathering soils, which in many cases adjoin them. Similarly, the more sandy or loamy middle Franconian diluvial soils are concentrated in a comparatively narrow region of acid reaction, and finally the loamy-soils of the upper-Bavarian "high-terrace" differ from the soils of the newer "valley-terraces" and partly from those of the "lower-terraces" in that they have in the majority of cases a weakly acid to a strongly acid reaction.*

In recent times investigations were begun on the reaction character of the diluvial loamy-soils and Miocene-sand and gravel lying in the Tertiary belt south of the Danube. The similar investigations of the previous year indicated a considerable heterogenity and a distribution over a large P^H region (see Table II). The results obtained could not have been used as evidence for two reasons, firstly because the number of soils investigated was far too small, and secondly, because the soils investigated were, geologically considered, of a too heterogenous character. This year's investigations on these quaternary soils, after separating out the deeper layers of a Liass character, showed mostly an acid reaction.

In the end, such systematic treatment of the results obtained in the geological investigations of geologically typical series of soils, will enable us, through careful formation of generalisations, to advance the knowledge of the chemical behaviour, which is of such great importance to agriculture.

The amount of care to be exercised depends upon whether:

(1) in taking the sample, attention was paid to the agricultural and manure-technical, as well as to the plant-organisation side;

(2) attention was paid to the geological section (profile) and thus to the mode of formation;

(3) the soil is horizontal or whether inclined and in what direction ;

(4) in summing up the results of the investigations on the chemical character attention was also paid to the differences in the analyses of the different soils, which often occur even in limited spaces.

Only if and when all these points have received the attention they deserve, are we entitled to apply deductively, the conclusions arrived at in the chemical investigation of geologically homogenous series of samples, to corresponding kinds of soils. From our experience we advise very special care in the treatment of samples supplied. *Such systematically carried out investigations will give for homogenous series of soils, a typical series of numbers lying within a constant and limited P^H region.* In this way it will be possible to prove the existence of many other acid soil-types, *in which the base-deficiency is geologically and agriculturally caused, which showed itself, may be, for a long time in bad harvests or lime-deficiency, or may have existed for a long time in a latent state and became active only through the use of an unsuitable artificial manure.* The recognition of these facts will put in their proper place the very general statements as to the injurious action of acid manures.

H. NIKLAS and F VOGEL (reporter),
Institute of Agricultural Chemistry,
of the High School of Weihenstephan.

BIBLIOGRAPHY AND NOTES.

(1) RAMANN. Bodenbildung und Bodeinteilung. Berlin, 1918.
(2) W. KOEHNE and H. NIKLAS. Erläuterung zu Blatt. Ampfing, Mühldorf, Baierbrunn, Gauting u. s. w. der geognostischen Karte von Bayern 1 : 25,000 und E. KRAUS, der Blutlehm etc. Geognostische Jahreshefte von Bayern, 34. Jahrgang, 1921.
(3) A review of the work, of R. GANS is given in *Internationale Mitteilungen für Bodenkunde*, Vol. III (1913), p. 529.
(4) More details of the organisational work are to be found in *Landwirtschaftliches Jahrbuch v. Bayern.* Jahrgang, 1925.
(5) Since September 1924 a further number began sending in samples.
(6) *Landwirtschaftliches Jahrbuch von Bayern,* Jahr 1925.
(7) This number increased from 1-9-1924 till 28-2-1925 by 2 481 soil samples.

(8) We have to deal here with the influence of carbonic acid. The influence of carbonic acid is strongest in the region of P^H 6-7, although it is felt in the region P^H 5-7.

(9) In drawing the curves we always used the upper value of the P^H interval, from table II, as the abscissae, thus, e, g., for P^H 6.01-6.5 we used 6.5. In this way the curves represent the hydrogen-ion concentration in water extract. It is worth noticing that the shifting caused by the curves in the coordinate system affects unfavourably especially the curves of the acid soils.

(10) These observations are in agreement with the exhaustive investigations on the lime-content carried out at the central agricultural experimental station Munich in the years 1892-96, and which was then under the direction of SOXLETH. The results then obtained show in the case of nearly all soils of the Bavarian forest, deficiency in carbonate of lime.

(11) *loc. cit.*

(12) *loc. cit.*

(13) H. NIKLAS in the explanations to the Mühldorf section of the geological map of Bavaria (1 : 25,000) p. 82, has drawn conclusions from the results of the chemical investigations on the soils as to the their lime rerequirements, and he and W. KOEHNE — the latter from the results of borings — concluded that the soils of the Pietenburg level require lime urgently, while those of the younger Inn terrace do not need liming. Except the recognition whether a particular soil requires liming or not, a decisive factor in the choice of a manure is the reaction character of the soil. It would therefore be of great importance to the scientific advisers of the practical farmer if they could indicate, on the basis of a knowledge of the reactions of certain widely distributed soils, the best manures, i. e., yielding optimum results for a given soil.

THE CLASSIFICATION OF SOILS ON THE BASIS OF ANALOGOUS SERIES IN SOIL FORMATION.

The problem of the classification of soils, the history of which is almost as old as the history of soil investigation itself, has not yet reached a satisfactory solution. In particular, it is not yet completely resolved by the Russian pedologists, though the latter proposed several schemes for classification of soils. Among this classification two were of greater importance in the development of soil investigations in Russia, those of Prof. N. Sibirceff (1895) (1) and Prof. K. Glinka (1902). (2) The classification of Prof. Sibirceff is based on the principle of *zonality*, that is on the factor characterizing their geographical extension on the surface of the globe. The classification of Prof. Glinka is constructed according to the factor of *humidity*, because he considers that moisture is the pre-eminent factor in soil formation.

From personal investigations and analysis of material collected by Russian pedologists, it was possible for the author to establish that soils form several genetically independent divisions, whose soil-formation is quite specific. Within the limits of every division the soil passes a determined cycle of development — *progressive* — till the moment of maximal expressiveness of its properties and — *regressive* — from the moment of its beginning to decompose into more simple integral parts. The fundamental stages of this cycle are called *types*. In the first instance can be named four divisions: *thermogenic, phytogenic, hydrogenic, and halogenic*. In the best investigated phytogenic division found in the temperate zone of the globe, the process of the evolution of soils is conceived as follows:

In the first stage of development, in *desert*, we have a *crust weathering* in different stages of decomposition, not at all subject to the influence of the phytosphere and only in a slight degree to that of the hydrosphere. In the next stage, in the zone of *half-desert*, the soil-cover is represented by a type with scarcely marked morphological signs — *grey-soils*, in which the soil-formation is expressed by washing out of easily soluble alkali-salts, some alkalisation of alkaline-earths and insignificant accumulation of organic matter. Therefore a difference between the soil and the material rock is observed in the chemical composition only; as to the morphology, there are scarcely visible signs of difference. Further, in the zone of *dry steppe*,

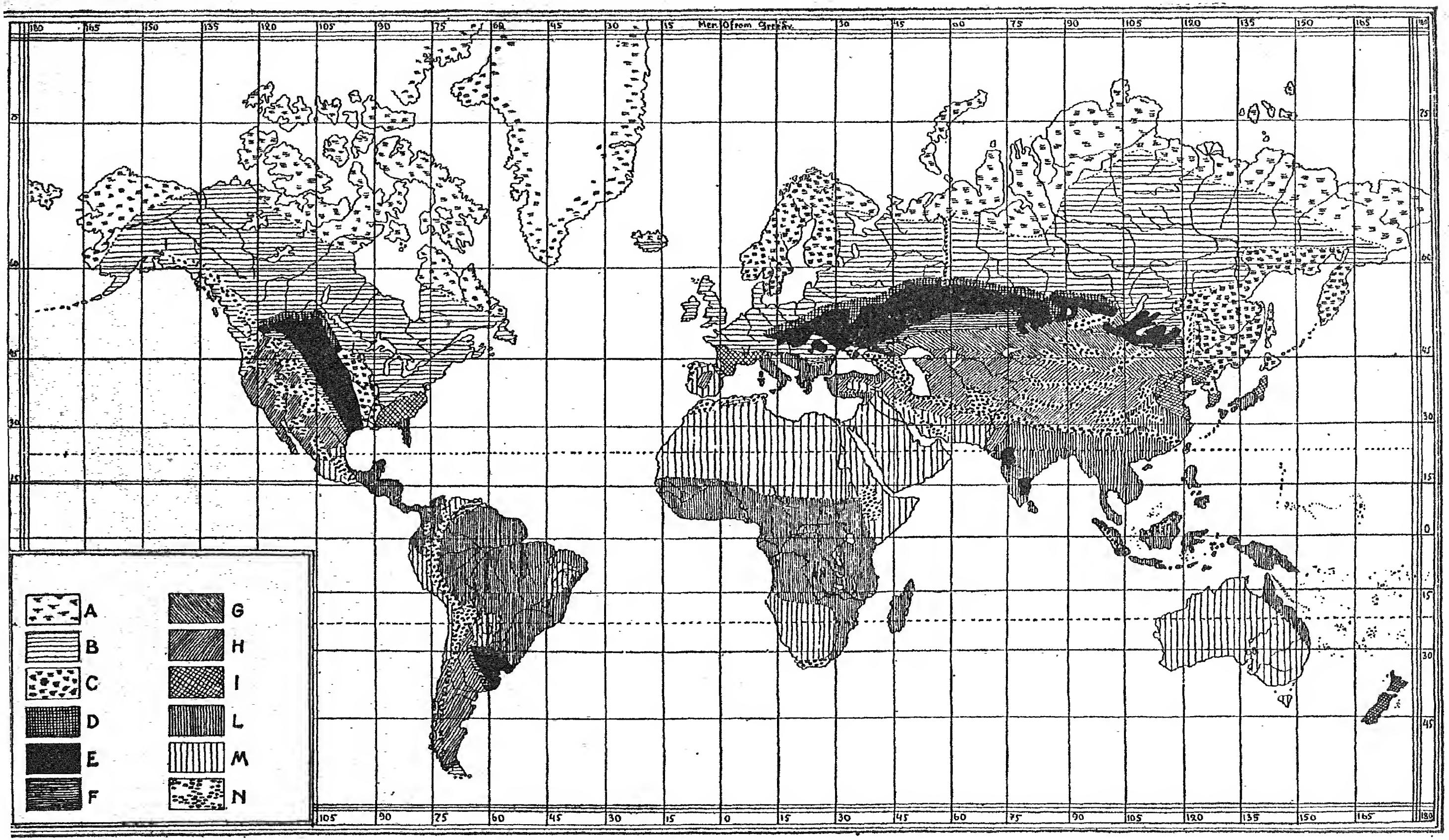


FIG. 263. — Sketch Map of the soil-cover of the world, after Prof. K. D. GLINKA.

we meet rich *brown* and *nut-brown* soils, in which the process of soil-formation is expressed by alkalization of alkaline-earths, especially in the form of carbonates, which form a distinctly marked alluvial horizon. At the same time a visible accumulation of organic matter is observed, the soil begins consequently to acquire a definite structure consisting of three horizons.

The next, *black-soil zone,* with fertile *chernoziom,* is characterised by the full alkalization of carbonates of alkaline-earths and the maximum accumulation of organic matter. In this stage the soil is at the height of its properties, power and productivity. With this stage finishes the first — *progressive* — period of history of the development of the soil. After this period in the development of soil begins the second stage — that of regression and dying away. This period begins with the *grey forest, nut-like soils,* which form generally, as a consequence of the development of forests on the black soil. At the same time, in consequence of more mobile combinations, the process of humification nearly stops; the former stores of humus are alkalized by the soil solution, continually streaming downwards, because, in consequence of the setting free of absorbed Ca, the humates become mobile and are drawn away by soil-solutions into the depth of the lithosphere. With the decomposition of organic matter its protecting and conservative influence ceases, and an energetic process of further weathering of mineral substance of the soil takes place; it consists now in transferring the oxides deeper into the ground. The carbonic acid, set free in abundance by the energetic mineralization of organic residues, probably plays a great part in this last process of *ash-like soil formation.* This process in course of its development leads the soil to the conclusion of the cycle of its evolution — poor *ash-like soils* (podsol), when all more or less mobile substances are removed and only the inert silica remains in the composition of the soil mass. Such a soil cannot be a source of food material for herbaceous plants, except the simplest forms. It is suitable for trees, which obtain food material from the deeper layers. An analogous cycle of development of the soil-cover is to be found in every division of soil-formation. For instance among the *salted soils* of the temperate zone the division of *halogenic* soils consists of six types, which in their morphology, chemistry and distribution are quite analogous to the above mentioned types (3). It is possible to observe the same series in *thermogenic* soils of the torrid zone *laterites.* Notwithstanding the scarcity of investigations in this zone, it is quite established that, the

TABLE I. — *The Classification of Soils by Prof.* D. VILENSKY.

Series / Division	A	B	C	D	E	F
	Type	Type	Type	Type	Type	Type
Thermogenic T	Red soil of tropical half-desert TA	Red soil of arid savannah TB		Red soil Laterite TD	Degraded red soil TE	Ash-like red soil TF
Phytogenic P	Grey soil PA	Brown soil PB	Nut-brown soil PC	Blacksoil (Chernoziom) PD	Grey nodular soil PE	Ash-like soil (Podsol) PF
Hydrogenic H	Tundra soil HA	Half-bog soil HB		Bog soil HD		Ash-like bog soil HF
Halogenic G	Dry salt soil GA	Prismatic soil GB	Pillared alkali GC	Black pillared alkali GD	Nodular alkali GE	Ash-like alkali GF
Thermophytogenic PT	Yellow soils					
Thermohydrogenic TH	Bog soils of torrid zone					
Thermohalogenic TG	Salt soils of torrid zone					
Phytohydrogenic PH		Pasture soil PHB		Black pasture soil PHD	Grey nodular soil PHE	Ash-like soil PHF
Phytohalogenic PG	Alkaline grey soil PGA	Alkaline brown soil PGB	Alkaline nut-brown soil PGC	Alkaline black soil PGD		Alkaline ash-like soil PGF
Hydrohalogenic HG	Light chloride sulphate salt soil HGA			Black carbonate salt soil HGD		
Orogenic O	Greyish pasture soil OA	Brownish-grey pasture soil OB	Sward-pasture soil OC	Black pasture soil OD	Grey nodular soil OE	Ash-like soil OF

process of soil formation in this region begins and finishes by types quite analogous to the corresponding ones of the temperate zone (4). Finally the same is to be observed in the *hydrogenic* division of *bog-soils,* distributed in the cold zone.

The author's classification (tab. 1) has for basis those analogous series in soil formation. Its highest classification unit is the *soil division.* The characteristics of those divisions are:

1. *Thermogenic division.* Distributed in subtropical, tropical and equatorial regions of the *torrid zone,* independently of the quantity of precipitation, that is to say, in half-desert, savannahs and forests. The prevalent factor of soil formation in this zone is the high and constant temperature, favourable to a rapid and complete (to the formation of CO_2) mineralization of organic residues and increasing the energy of chemical weathering of mineral substance of the soil. Enriched by CO_2, the soil solutions bring about rapid and energetic hydrolysis of silicates and alumino-silicates and remove not only the bases, but also the silica (quartz-silica excepted). As products of weathering, the hydrates of the oxides of iron and aluminium chiefly, also Mn_3O_4 and TiO_2 are accumulated and form the greatest part of the soil mass. As admixture, there are found grains of quartz, kaolinite, and incompletely weathered residues of minerals of the mother rock. Under the influence of high temperatures the oxides of iron dehydrate and pass into the form of less mobile anhydrates, *turite* especially, which causes the prevalence of a red colour among the soils of the given division. The intensity and the character of this colour varies in accordance with the content of iron in the maternal rock. The soils of the given division, as well as of all those following, are formed on all kinds of rocks, eruptive and sedimentary, in the primary and secondary (alluvial, eolik) layers. If the process of soil formation is of long duration the lithosphere can be penetrated to a very considerable depth.

2. *Phytogenic division.* Distributed in all regions of the temperate zone, independent of the amount of precipitation. The predominant factor of soil formation is the vegetation, causing considerable accumulation of decomposed organic matter in the soil. This accumulation is the result of insufficient energy in the decomposition of organic matter, owing to the comparatively low annual temperature and a long period of winter rest, during which the biological processes in the soil are interruped. The organic colloidal complexes (humates), absorbing the alkalized bases, hinder the process of weathering of

alumino-silicate substances of the soil, already delayed by the moderate temperature and the feeble activity of the soil solution. The accumulation of the most characteristic part of this soil, the decomposed organic matter, in consequence of its feeble stability, takes place only in external horizons of the mother rock and the process of soil formation does not reach a great depth.

3. *Hydrogenic division.* Chiefly distributed in the *cold region* — tundra and the adjacent part of the forest zone — but occurs in other zones also, if the special conditions of relief cause the stagnation of surface water, or the rise of soil water. The prevalent factor of soil formation in this division is the water, which acts directly, causing a heightened hydrolitic decomposition of the alumino-silicate part of the soil and indirectly forcing the air out of the soil and causing anaerobic conditions. Under the influence of water with carbonic acid in solution an energetic hydrolysis is produced which sets free large quantities of the elements of the silicates, as well as of organic-mineral substances. Therefore the marshy horizons have always, even in tundra, an alkaline reaction. Under the influence of alkaline water solutions, containing bicarbonates, the weathering of alumino-silicates takes place and brings about the formation of clays and accumulation of alumina, while the bases and oxides of iron are alkalized. The mobility of the chemical combinations of iron is quite evident in this case, because in the bog soils there are conditions suitable for the formation of protoxide of Fe combinations. Consequently in the bog soil there occur a whole a series of chemical compounds of iron, unknown in other soil types, among them: vivianite, sulphur compounds, FeS, FeS_2 (pyrite, marcasite), $FeCO_3$. At the same time, in consequence of imperfect aeration, the decomposition of organic matter proceeds very slowly and remains unfinished. It results in accumulation of a great quantity not only of humus, but also of carbonized organic matter, preserving traces of organisation.

4. *Halogenic division.* The principal factor of soil formation in this division is the saltness of the mother rock, or to be more exact, the *content of the absorbed sodium* in its colloidal part. This salinity can be of different origin: geological (sea-sedimentary), as well as that of soil (salt soils). When the rock is impregnated with sodium salts, an absorption of it takes place by colloidal complexes of sodium. Then, after the washing out of the rock or the salt soils of easily soluble salts, begins the alkalization of absorbed bases, during which soda is formed by the process of exchange of absorbed sodium for

calcium of $CaCO_3$ (5). The enrichment of soil solutions by soda makes them a very energetic reagent, producing first the alkalization of decomposed organic matter and then of oxides, both being in the alkaline solution in the form of zole. Penetrating through cracks and capillary vessels into the depth of the rock, they form not far from the surface, an alluvial horizon, overfilled with colloids, which in the dry state forms distinct prismatic or pillared pieces, and when moistened swells, becomes water-tight and creates on the surface of the soil the conditions of temporary saturation. In consequence of very unfavourable physical properties of the soil, of a considerable alkalinity of its external horizons and of the presence at a slight depth of easily soluble salts, the vegetative cover of halogenic soils is, as a rule, poor and sparse, the accumulation of decomposed organic matter insignificant, the greater part of it being immediately alkalized into the alluvial horizon. Being bound by its origin to a particular property of the mother rock, its salinity, which depends upon the origin of the rock and can be met everywhere, the halogenic division is intrazonal.

Nevertheless, as the salinity itself of the mother rock, especially the secondary one, arising during the soil formation, takes place more easily in the conditions of a hot and dry climate, where evaporation prevails over precipitation, those soils are mostly distributed in steppe and half-desert regions.

Such are the properties, origin and distribution of the *fundamental divisions* of soil formation. Between them there may exist, and really do exist, *intermediate divisions*, uniting fundamental properties of the two, though in a very changed form. Those divisions are:

5. *Thermophytogenic division.* It consists of the little investigated yellow-brown and reddish-yellow soils with low content of humus and considerable quantity of oxides. Distributed in South Europe (France), Japan, South-Eastern United States. They are united by Prof. GLINKA in one group, to which he gives the name of *yellow soils* (6). Their types are not yet investigated even approximately.

6. *Thermohydrogenic division.* To this division belong half-bog and bog soils of equatorial, tropical and subtropical regions, very little investigated.

6. *Thermohalogenic division.* To this division belong the salt soils of the torrid zone, whose morphology, chemistry and geography

THE PRINCIPAL SOIL - TYPES OF THE WORLD.

By Prof. D. G. VILENSKY. Drawn by M. Podjakonoff.

ıermogenic division

T

Torrid zone

A

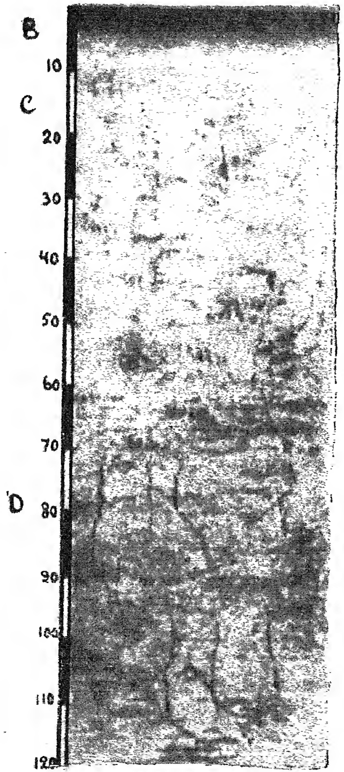


FIG. 264.

B

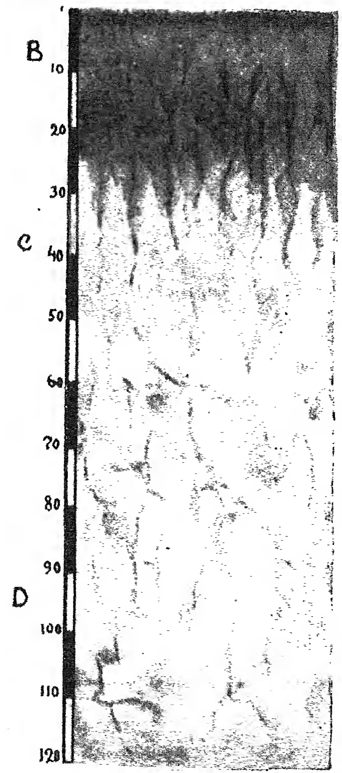


FIG. 265.

C

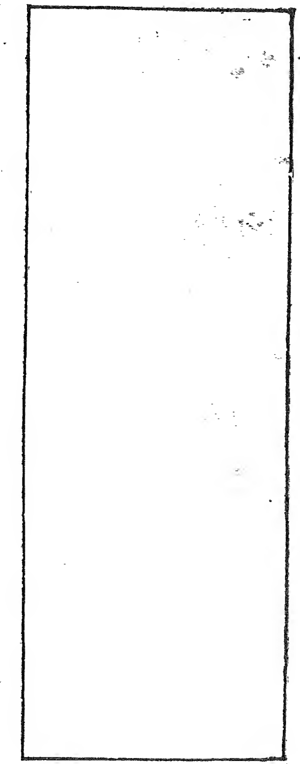


FIG. 266.

THE PRINCIPAL SOIL - TYPES OF THE WORLD. PLATE XCVI.

By Prof. D. G. VILENSKY. Drawn by M. Podjakonoff.

ıermogenic division
T

Torrid zone

D

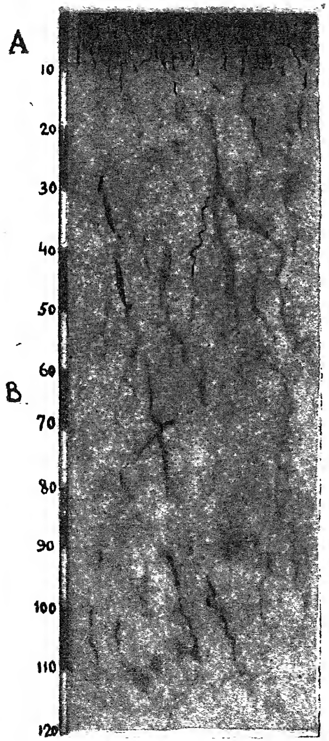


FIG. 267.

Red soil - Laterite soil.

E

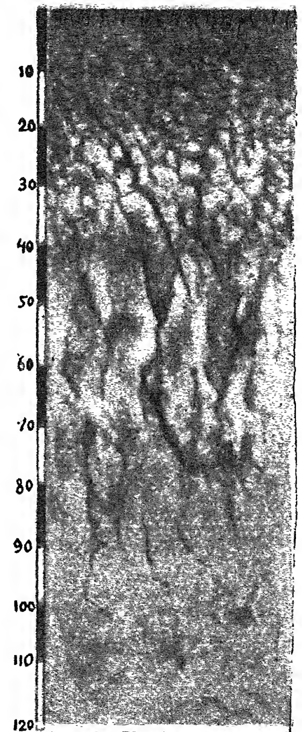


FIG. 268.

Degraded red soil.

F

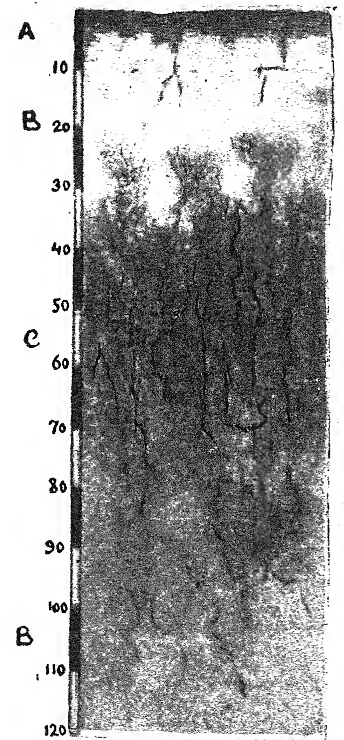


FIG. 269.

are, from the point of view of contemporary pedology, as little investigated as those of the previous divisions.

8. *Phytohydrogenic division.* To this division belong the soils of the forest region of the northern part of the temperate zone, from the sward-soil to the ash-like and, in particular, the meadow-soil. The process of soil formation in this division, owing to the especially favourable properties of the zone in question for the settlement of tree-vegetation, progresses very rapidly and we often meet there its last stages, the ash-like (podzol) soils.

9. *Phytohalogenic division.* To this division belong slightly alkaline soils, intermediate between phytogenic soils and alkaline. They form types quite analogous to those of phytogenic soils.

10. *Hydrohalogenic division.* Includes *salt soils* which are formed where the conditions of the relief allow the soil water to approach the surface, so that its evaporation from the surface becomes possible. If the soil water contains in solution a considerable quantity of mineral salts, those salts are concentrated on the surface of the lithosphere in gradually increasing quantity. As a rule, in those soils the upper horizon is saturated with easily soluble salts, and the lower horizon has the characteristic of swampness.

The ten enumerated fundamental and intermediate divisions of soil formation embrace, as it appears, the whole number of soil-bodies formed on the surface of the earth in conditions of plain, as well as of mountain relief. Only in regard to the last, the possibility is not excluded of classifying the group of soils, known as *high-mountains soils*, into a separate division of *orogenic* soils, quite independent of others. It might be done in course of time, after investigation of mountain soils in a greater number of regions.

The soils of divisions in the classification table (Table I) form the horizontal rows. Every division is divided into six types and those types form the basal units of the soil cover. The types are analogous in all the divisions and therefore they form the vertical rows in the classification system. Consequently, every type lies at the point of intersection of the two coordinate divisions and series. In the total, with 11 divisions, 66 types find their natural place in the table. Their existence is theoretically quite possible; in fact, only 42 have been at present investigated.

The characteristics of the principal types described are as follows.

I. Thermogenic division.

T. A. *Red soil of the tropical half-desert.* Is characterized by insignificant thickness of alluvial horizon (B = 6 cm.) (7), yellowish-red colour, slightly foliated structure and friable texture. Under the above mentioned horizon lies the alluvial horizon in separate patches, more often a whole layer of lime and gypsum; effervesces on the surface with HCl. Described up to the present only in the halfdesert of North Africa(in Algeria) by the pedologist DRANICIN (8).

T. B. *Red soil of arid savannah.* Hor. B. about 25 cm. thick, brown-red, structure very slightly shown as a thin crust on the surface. Hor. C. mostly compact, structurless lime flag. Effervesces on the surface with HCl. Distributed in arid alfa (*Stipa tenacissima*) savannah of North Africa.

T. D. *Red-soil Laterite.* Consists almost exclusively of one hor. B, characteristics of A and C. very slightly shown and their nature has been very little studied.

The thickness of B is very considerable. Nevertheless we have no exact knowledge of it in the conditions of the primary layers of the soil. The colour of the horizon varies: red, crimson, orange, downwards generally yellowish, upwards tending to a brown tint. Structure indistinct, cloddy, texture friable, spongy or cellular. The type described distributed in all subtropical, tropical and equatorial regions of the world; nevertheless, its characteristics and nature from the point of view of genetic pedology are almost unstudied, in particular it is even unknown, whether it is formed under the herbaceous, or under the tree vegetation.

TE. *Degraded red-soil.* Hor. A, 20 cm. thick, of brownish-grey colour, friable, in the lower part nodular structured. Hor. B, 20 cm. brownish-orange, indistinctly nodular in structure. Hor. C, 35 cm., orange with brown or tawny-brown spots and veins, cloddy, dense. Under it lies the hor. B of the former red soils. Described by Prof. ZACHAROFF in Georgia near Batoum (9).

TF. *Ash-like red soil,* Hor. A, 4 cm. thick, straw-colored, grey, friable, structureless; hor. B, 30 cm. thick, in the uppper part whitish, slightly nodular in structure, friable, in the lower part whitish-yellow structureless, compact; hor. C, 40 cm. thick, dark brown with red spots, structureless, dense. Under it lies the hor. B of the former red soil. In hor. B and C occur Ortstein particles. Described by Prof.

THE PRINCIPAL SOIL - TYPES OF THE WORLD.

By Prof. D. G. VILENSKY. Drawn by M. Podjakonoff.

Phytogenic division
P

Temperate zone

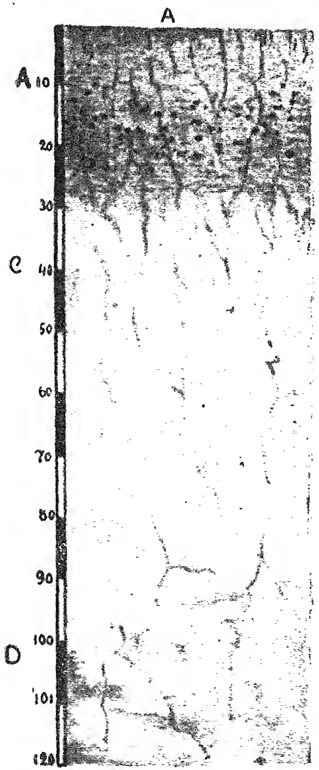


FIG. 270.
Grey soil

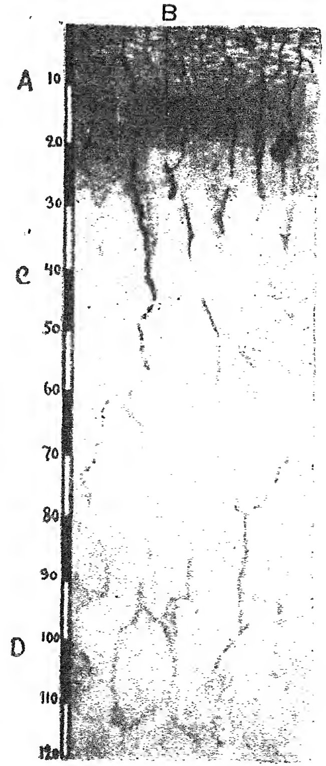


FIG. 271.
Brown soil

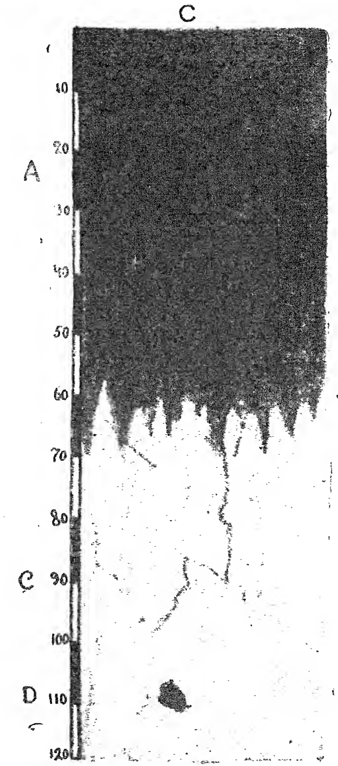


FIG. 272
Nut brown soil.

THE PRINCIPAL SOIL - TYPES OF THE WORLD.

By Prof. D. G. VILENSKY. Drawn by M. Podjakonoff.

Phytogenic division
P

Temperate zone

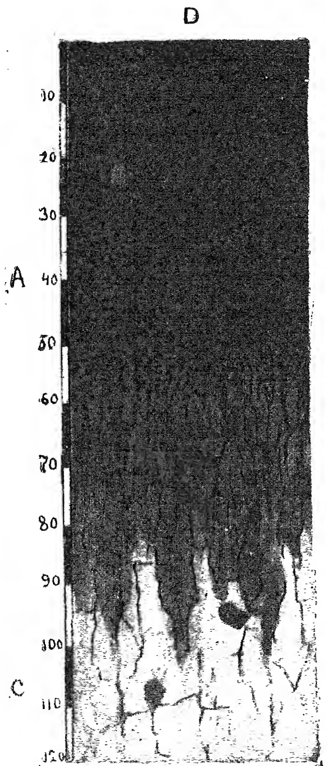


FIG. 273.
Black soil.

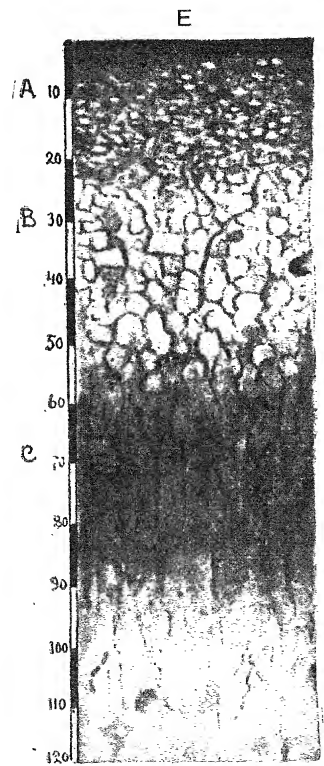


FIG. 274.
Grey nodular soil.

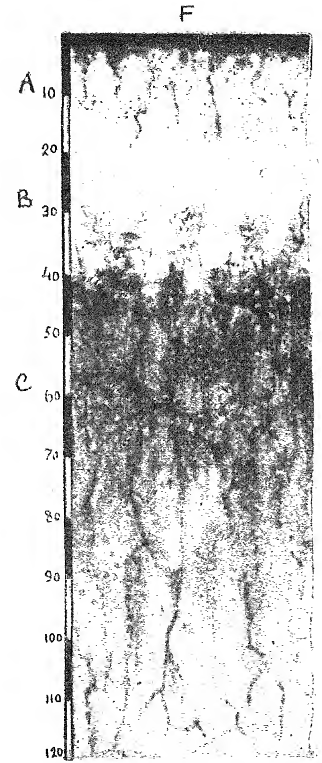


FIG. 275.
Ash-like soil.

THE PRINCIPAL SOIL - TYPES OF THE WORLD.

By Prof. D. G. VILENSKY. Drawn by M. Podjakonoff.

Hydrogenic division

H

Cold zone

A

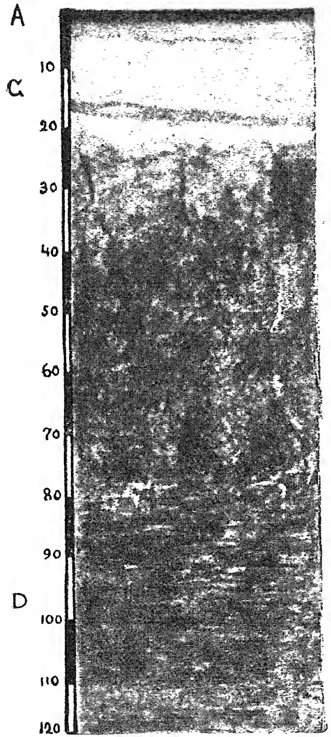


FIG. 276

Tundra soil.

B

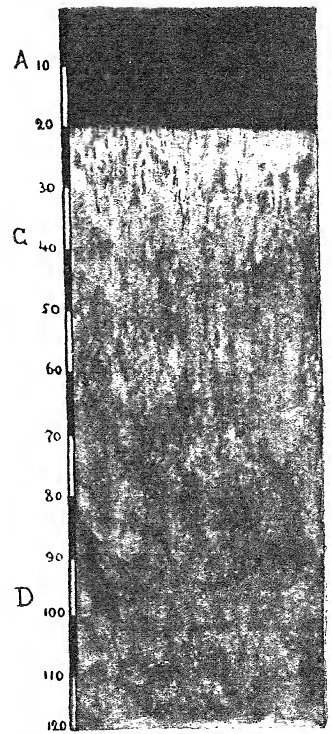


FIG. 277.

Half bog soil.

C

FIG. 278.

THE PRINCIPAL SOIL - TYPES OF THE WORLD.

PLATE C.

By Prof. D. G. VILENSKY. Drawn by M. Podjakonoff.

Hydrogenic division

H

Cold zone

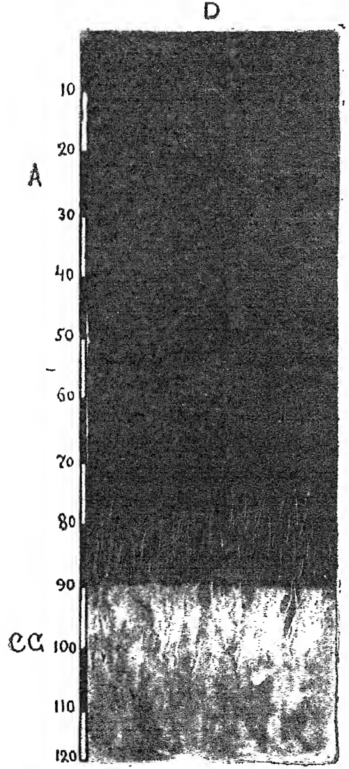


FIG. 279.

Bog soil.

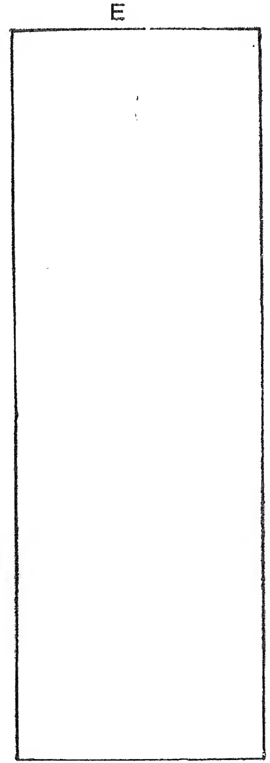


FIG. 280.

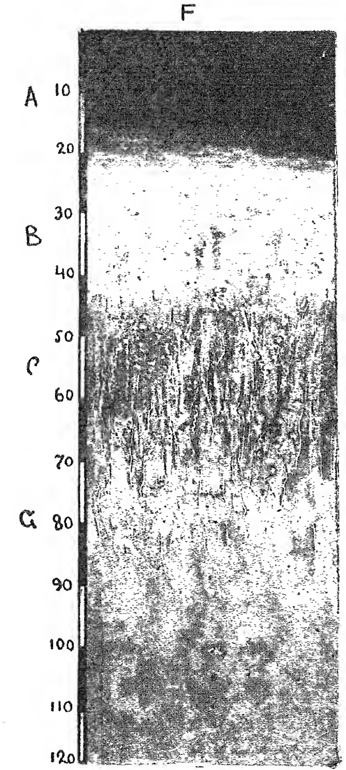


FIG. 281.

Ash-like bog soil.

ZACHAROFF in Georgia near Batoum, but there are indications, as to its distribution in many parts of the torrid zone.

II. Phytogenic division.

PA. *Grey soil.* Hor. A about 30 cm. thick, light-grey with whitish-yellow, or brown tint, scaly in structure, with a great number of insects and worm tracks. Hor C 50-100 cm. thick, whitish, very dense, carbonate in upper part, in lower part has veins of gypsum. Effervesces on the surface. This type is zonal in the half deserts of the temperate zone and is distributed in Spain, Turkey, East-Transcaucasus, Persia, Turkestan, Mongolia, the Far West of the United States, Brazil and Argentina.

PB. *Brown soil.* Hor. A, 30-40 cm. thick, brown coloured, slightly foliated in upper part (A_1) more dense and slightly vertically clefted in lower part (A_2). Hor. C, 50-60 cm. thick, whitish, strongly carbonaceous. Usually effervesces in hor. C. Is zonal in South part of arid steppes of temperate zone and is distributed in South-East of European Russia, in Kirgis-district, Hungary and Mongolia. Its distribution on the other continents has nor been studied.

PC. *Nut-brown soil.* Hor. A, 60-70 cm. thick, nut-brown coloured, in the upper part (A_1) slightly foliated, in the lower part (A_2) more dense, roughly cloddy with distinctly shown vertical clefts. Hor. C, sharply shown, pre-eminently carbonaceous, but frequently contains gypsum. Carbonates mostly as completely formed units, most often as white masses. Effervescing as usual in hor C. Zonal in northern part of arid steppes of temperate zone. Distribution: Hungary, Roumania, South Crimea, South-East of Russia, Southern part of Western Siberia to Altai, South Transbaikal and Manchouria.

PD. *Black soil* (chernoziom). Hor. A 70-100, even to 150 cm. thick, in upper part (subhorizon A_1) black with greyish or nut-brown tint, granular structured, in lower part (A_2 beginning at the depth of 40-50 cm.) of lighter nut-brown colour and cloddy-prismatic structure; gradually passes into the next hor. often in tongues, or in streams. Hor. C is rather distinctly shown, consists of sharply formed limy concretions. Effervesces in C. Zonal in northern part of steppes of temperate zone, distributed in Poland (Galicia), Hungary, Roumania, European Russia, West Siberia to Baikal, South Transbaikal, United States of America (on the prairies) plateau of the Far West, and in Argentina.

PE. *Grey nut-like soil.* From above, a forest cover 2-5 cm. thick, under it the hor.A 25 cm. thick, grey, finely nodular in structure. Hor. B 20-30 cm. thick, greyish, or ash-brown with grey silica and dark humus patches; of coarse nodular structure, becoming coarser towards the lower part. The surface of nodules is mealy, silicious, speckled. Hor. C to 100 cm. and lower, reddish brown, very dense, with vertical clefts and dark brown streams over them; 200-120 cm. deep, frequent limy concretions. Distributed under leaved woods in zone transient between forests and steppes — in Eurasia: Poland, European Russia, West Siberia to Baikal.

BF. *Ash-like soil* (Podzol). From above, a forest cover to 5 cm. thick, underneath, hor. A 10-15 cm. thick, light-grey, thinly granular, friable. Hor. B, 15-25 cm. thick, whitish or completely white, slightly foliated, light with misty-brown Ortstein particles. Hor. C, reddish-yellow, with numerous Ortstein particles, very dense, mostly structureless Distributed in forest districts of Eurasia, on other continents unstudied.

III. Hydrogenic division.

HA. *Tundra soil.* Hor. A-3 cm. thick, grey-brown, consists of humus partly, with some decomposed plant residues. Beneath it lies the hor. G (10) 8-10 cm. thick, of dove-grey colour, very sticky.

It is distinctly separated from the hor. A and D by a yellowish-brown ochreous layer 2-3 cm. thick. Hor. D is compact, brownish-grey, not flowing. At a depth of 79 cm. the permanently frozen layer is often found. This type forms the soil cover of the dry tundra. but its nature and the conditions of its distribution have been scarcely investigated. Described in the tundra of Asiatic Russia by Profs. SUKACHEFF (11) and DRANICIN.

HB. *Half-bog soil.* Hor. A to 20 cm. thick, brownish-black, more or less turfy, distinctly separated from the underlying layer. Hor. G. of varied thickness (15-20 cm. and more), dove-grey with greenish or bluish tint, with brown and rusty spots and veins. This type is usually considered as intermediate between marshy and not marshy soils and has been very little investigated. Largely distributed in the tundra and in the north part of the forest-zone.

HD. *Bog soil.* Hor. A 80-90 cm, thick, in upper half brown-coloured, turfy, in the lower (subhor. A_2), black, rich in decomposed organic matter, abruptly passes into the next layer.

Halogenic division

G

'razonal in temperate zone

A

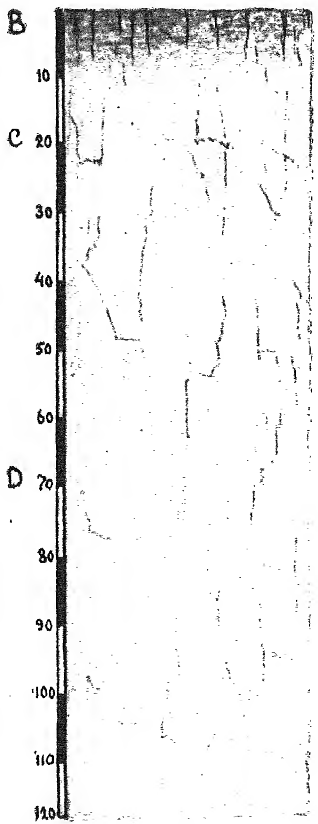


FIG. 282.

Dry salt soil.

B

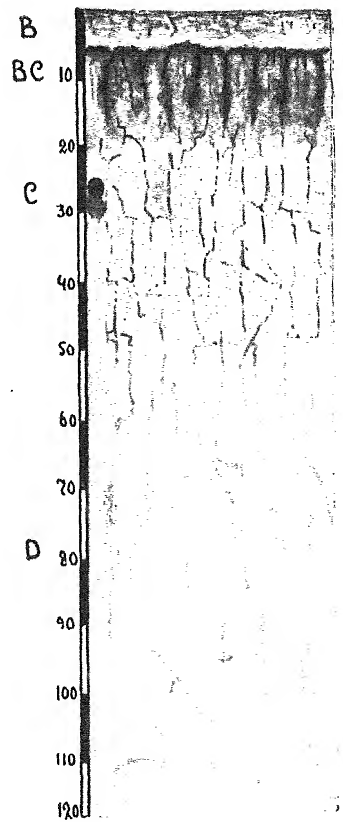


FIG. 283.

Prismatic alkali.

C

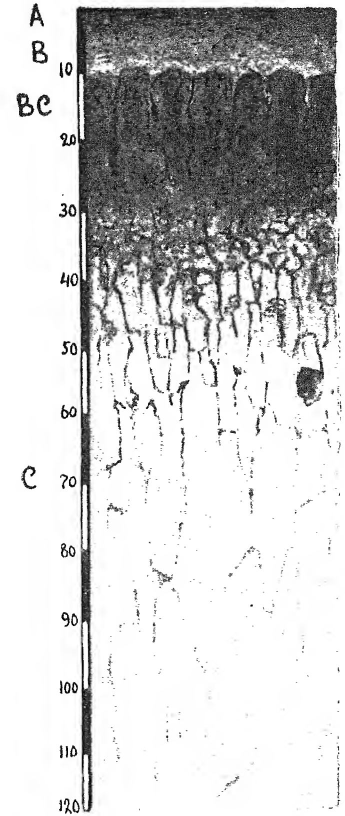


FIG. 284.

Pillared alkali (Solonetz).

Halogenic division
G
ntrazonal in temperate zone

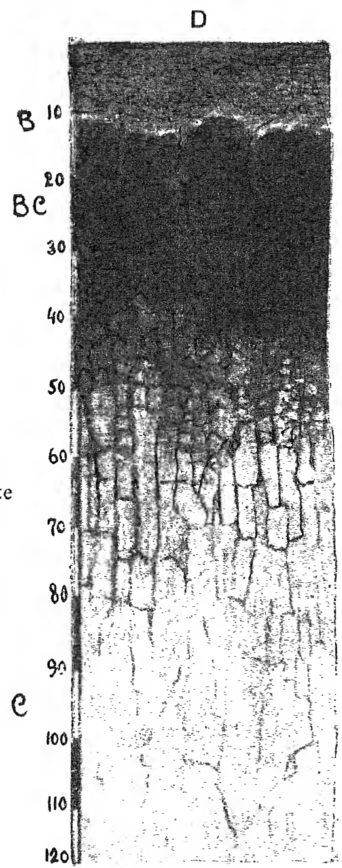


FIG. 285.
Black pillared alkali.

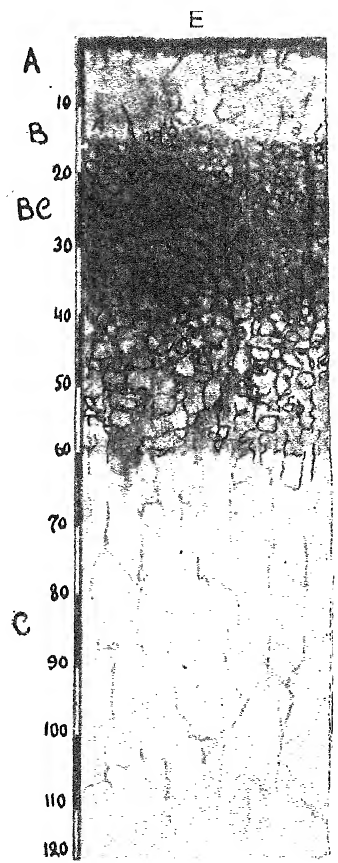


FIG. 286.
Nodular alkali.

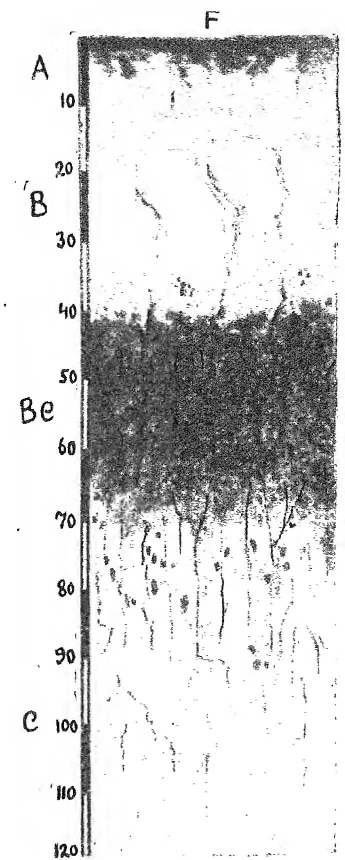


FIG. 287.
Ash-like bog soil.

Hor. G, of varied thickness, greenish or bluish, with a great number of patches and veins of hydrates of oxides of iron. Largely spread in tundra and in the forest zone.

HE. *Ash-like bog soil.* Hor. A, 20 cm. and more thick, black, half-turfy, in the lower part somewhat lighter coloured and less turfy. Hor. B, 20 cm. thick, dirty-grey, with dark humus patches and compact Ortstein particles, 1-2 mm. in diameter. Hor. G, sticky, dove coloured or greenish, with rusty spots, veins and Ortstein particles. The common type of soil-cover in the north part of the forest zone of Eurasia.

The soils of the hydrogenic division have been in general very little investigated and the types HC and HE were hitherto unknown in this division.

IV. Halogenic division.

GA. *Dry salt soil.* No hor. A. On the surface of the hor. B a very dense porous crust, smooth from above, as if polished, divided by a net work of clefts into parquetry-like partitions. Downwards it acquires a rather distinct scaly and flaggy structure The whole of hor. B is 10 cm. thick. Hor. C, without signs of infiltration, gradually passes into the hor D. Effervesces on the surface. To this type belong the dry salines — "takyri" — (in Kirgiz) of the semi deserts of Turkestan.

GB. *Prismatic alkaline soils.* Hor. B, 1-7 cm. thick, light-brown, leafy structure, friable, porous. Hor BC, 10-15 cm. thick, breaks into pieces of prismatic form, which are easily divided into small clods. In colour, light tawny-brown, is a little darker, than the previous layer, better shown on the sides of the prisms. The density of hor. BC is considerable. Hor. C contains veins and patches of salts not effervescing, Effervesces from the surface. Hor. BC mostly does not effervesce. Distributed in the south of the arid steppe zone of Eurasia among the light-brown and partly brown soils.

GC. *Pillared alkaline soils.* Hor. A of insignificant thickness (1-5 cm.), often completely missing, light-brown, chestnut coloured, or tawny-brown, porous, always covered from above by a thin (1-2 mm.) crust, which cracks on drying into small polyhedrical flags. Hor. B 2-15 cm. and more thick, light whitish, mealy, distinctly foliated horizontally Hor. BD distinctly separated from the previous one, very compact, dark nut-brown, falls to pieces in the form of

pillars with a rounded top, 8-13 cm., high and 4-5 cm. thick. Downwards, hor. B grows gradually lighter becomes cloddy, nodular in structure and passes imperceptibly into C. Hor. C. distinctly alluvial, speckled with patches and veins of chlorides, sulphates and carbonates. Effervesces in hor C. Distributed in the region of nut-brown and brown soils of the steppes zone of Eurasia.

GD. *Black pillared alkaline soils.* Hor, A 6-12 cm. thick, black-coloured, foliated, friable. Hor, B 1-6 cm. thick, sometimes absent, light-grey or whitish, distinctly lamellar, porous, rather dense. Hor. BC 55-60 cm. thick, in the upper part consists of very compact polyhedrical pillars 10-15 cm. high and of the same thickness, with rounded tops. The colour of the pillars is intensely black, but from above and along the cracks they are covered with a thin whitish crust. Downwards, the hor. BC gradually grows lighter and in patches and tongues passes into C. Its structure is here nodular. Hor. C has distinctly shown signs of infiltration, as spots, veins and concretions chiefly those of lime. Effervesces at the depth of 35-40 cm. Distributed in the black soil zone of Eurasia.

GE. *Nodular alkaline soil.* Hor. A 10-20 cm. thick, dark-grey, generally structureless, rarely feebly foliated, rather friable. Hor. BC 50-60 cm. thick, composed of dark nodular clods with sparkling sides. Hor. C carbonate, structureless. Found only in the north part of the black-soil zone of West Siberia, where it is considerably distributed.

GF. *Ash-like alkaline soil.* Hor. A 17 cm. thick, in the upper part dark grey, deeper grey or whitish, friable. Hor B 11-25 cm. thick, compact, pillared, almost white, in the upper part finely foliated, in the lower part containing small brown clods. It contains many Ortstein particles especially in the lower part. Abruptly passes into the next horizon. Hor. BC 25 cm. and more thick, dense, dark, greyish and rusty-brown, falls into pieces of prismatic form, contains a great quantity of ochreous spots and grains. Hor. C structureless, rich in ochreous-rusty accumulations ($Fe_2O_3 . H_2 . O$). No effervescence. Distributed chiefly in the zone between forest and steppe, under birch and aspen forests, but also in the steppe-zone in low-lying areas.

The soil types in their turn are divided into smaller classification units: (1) subtype, (2) group, (3) variety.

The *subtype* characterizes the degree of the soil-forming process in the given type; the character of the *group* depends on the structure of the mother rock; *variety* depends on the composition of the fine

earth of the soil. In consequence, it is possible to continue the classification scheme in that way. (Tab. No. 2).

As no detailed appreciation of the proposed classification is entered into (12), we will only note the advantages which it has in comparison with the other existing classification of soils.

(1) It is *genetic* in the literal sense of this word, because it is based on the difference in the genesis of soil, while the greater part of other classifications proposed by Russian pedologists are *geographic*, as they took for a basis the distribution of soils.

(2) Being very simple, it is at the same time sufficiently wide and comprehensive, including a considerably larger number of types than has been described until now. Moreover it can be extended, or shortened without any difficulty, so that an augmentation or a diminution of the number of divisions and even of rows will produce no breaking either of principles of construction, or of the scheme of the classification itself.

(3) The disposition of soil under the form of a *periodical system* shows which types are not yet described, evokes the necessity of searching for them and gives the possibility to foretell their nature.

(4) The important advantage of the proposed classification is that it gives *the possibility to adopt a conventional designation of soils by alphabetical symbols under the form of soil-formulas.* We find that it is unnecessary to stress the importance of introducing into a concretely-descriptive classification the designation of described bodies by formulas. In Russia, particularly, has been felt long ago the inconvenience of the designation of types by composed words, which often becomes not a designation, but entirely a description of the soil. It appears also, that the same inconvenience is felt by Western European and American pedologists, who begin to use for designating certain types the foreign names. Therefore the introduction of an international language into soil-investigations becomes a pressing necessity. The simplest and most intelligible language in science is that of formulas. The principle of the construction of soil-formulae on the basis of the above mentioned classification is very evident. As was already shown the symbols of a type are two (in the intermediate divisions three) letters : a letter of the division and that of the series. The addition of the index 1, 2, 3, to the letter of the series designates the subtype. The group is designated by small letters *a-f* and the genesis of the mother rock by the addition of the index

Type		Brown	Nut-Brown	Black soil	Grey nodular soil	Ash like soil	Bog-soil
Sub-type	1	Light-brown	Light nut-brown	Southern	Degraded black soil	Slightly ash-like	Slimy
	2	Brown	Dark brown	Common	Dark grey	Ash-like soil	Turfy
	3	Dark brown	Dark nut-brown	Heavy	Light grey	Ashy-soil	—
		On alumino-silicate fine earth rock *a*	On carbonate fine earth rock *b*	On quarz-sandy fine earth rock *c*	On alumino-silicate skeleton rock *d*	On carbonate skeleton rock *e*	On quarz-sandy skeleton rock *f*
Group	1	Crystalline					
	2	Sedimentary					
	3	Moraine					
	4	Loess					
	5	Diluvial					
	6	Alluvial					
	7	Eolic					
Variety	1	Loamy					
	2	Clayey					
	3	Clayey sand					
	4	Sandy					

1-7 to those letters. The variety is designated by the figures 1-4 in front of the letters (the figure 1 is omitted).

Formulae:	designation:
$2P_3Cb_5$	Clayey, dark nut-brown soil, on the carbonate fine-earth diluvium.
$2\ P_2D_4b$	Clayey, common black soil on a carbonate, fine-earth loess.
PHF_3a_3	Loamy, ashy-soil, on a alumino-silicate fine-earth morena.
$2TFd_1$	Clayey, ash-like red soil, on an alumino-silicate, crystalline skeleton rock.
GCb_2	Loamy, pillared, alkaline soil on a sedimentary carbonate fine-earth rock.
$4PHF_3c_7$	Sandy ashy-soil, on a quartz-sandy fine-earth, eolic rock.
$2HGAb_6$	Clayey chloride-sulphate, salt soil, on a carbonate, fine-earth alluvium.

The above formulae, already simple, can be further simplified in accordance with the character and object of the investigations. In a brief description it is enough to mention the type and the variety, for instance, 2PD = Clayey black soil, PF = clayish-soil, etc., without indicating the subtype and the group, which requires a more thorough knowledge of the soil.

Summary.

1. *The soil* is a particular body of nature, extending like a fine epithelium over the surface of the lithosphere and forming *the pedosphere*, a particular cover of the terrestrial globe. *The pedosphere is the exterior horizon of the lithosphere, modified by the mutual interaction of the atmosphere, biosphere and hydrosphere.*

2. The soil is a product of the action of soil-forming agents, to which it is bound by functional dependence.

3. There are four fundamental soil-forming agents : *lithosphere*, *atmosphere*, *biosphere* and *hydrosphere*, the first being *passive* and the three others *active* agents of soil-formation.

4. The various modifications of the agents themselves as well as their combinations is the cause of variety in soil-formations.

5. This variety is largely connected with the external conditions, the principal of which are the *relief* and the duration of the influence of soil-forming agents (*the age of the soil*).

6. In different climatic zones of the world all the agents enumerated are not equivalent and the dominance of one of them over the others is quite obvious. In *the torrid zone* the chief soil-forming agent is *the atmosphere, in the temperate zone the bio-*, or to be more exact, *the phytosphere, in the cold zone the hydrosphere, the litosphere being an intrazonal agent.*

7. In accordance with the dominance of one or other agent, it is possible to establish four fundamental divisions of soil-formation: *thermogenic, phytogenic, hydrogenic, halogenic* and six intermediate divisions.

8. Within the limits of every division the soil passes through a definite cycle of development, *progressive*, until the moment of maximum expression of its properties and, *regressive*, from the moment of its beginning to decompose into more simple integral parts. The fundamental stages of this cycle are called *types*.

9. The *type* is the fundamental unit of the classification of the soil-cover.

10. The types in all divisions are disposed in *analogous series*, which makes it possible to construct the classification of soils on two coordinates, similar to a periodical system.

D. VILENSKY,
Karkow.

NOTES AND BIBLIOGRAPHY.

(1) SIBIRCEFF, N. M. *Bul. of Agricul. Inst. of Novaya Alexanrya*, Vol. IX. 1895-96.
(2) GLINKA, K. D. *Year-book of Geol. and Miner. of Russia*, Vol. V. 1902.
(3) VILENSKY, D. G. Alkali Soils, their Origin, Composition and Improvement. Moscow, 1924.
(4) DRANICIN D. *Works of Pedol. Committee of Dokuchaeff.* v. 3, 1915.
ZACHAROFF S.: *Bul. of Polytechnic Inst. of Tiflis* v. 1, 1924.
(5) GEDROIZ, K. K. *Journal of Exper. Agronomy*, v. XIII. 1912.
(6) GLINKA, K. *Pedology*, 2 edit. 1915, 354 p.
(7) The Russian pedologists distinguish in soils several genetic horizons, which they designate by letters, namely: A, *accumulative* hor., in which takes place preeminently the accumulation of organic matter (humus); B, *alluvial*,

in which organic matter, bases (R_2O and RO) and oxides of iron and aluminium (R_2O_3) are washed away, and which in consequence is rich in silica (SiO_2) ; C, *alluvial*, in which are found the materials washed out of the upper horizons (A-B) ; D-representing an horizon unchanged by the soil-forming processes, which is called *maternal rock, subsoil* or *ground*. The horizons in their turn are divided into sub-horizons (A_1, A_2, A_3 ; B_1, B_2, C_1, C_2, etc.

(8) DRANICIN, D. *loc. cit.*

(9) ZACHAROFF, *loc. cit.*

(10) Russian pedologists designate by the letter G the horizon of bog soils ("gley ") in which take place de-oxydating processes and in which are formed protoxide compounds.

(11) SUKACHEFF. *Bul. Ac. St-P.* 1911, No 1, 51 p.

(12) The detailed explanation is given in the Russian work : " The Analogous Series in Soil-formation and their Importance for Construction of Genetic Classification of Soils ". By Prof. D. VILENSKY, Tiflis, 1924.

Abstracts and Literature.

Soil Physics.

Some Factors influencing the Impermeabiilty of Soil.

BOTKIN, C. W. Paper read before the New Mexico Association of Science. (Chemist, Agricultural Experiment Station, State, College New Mexico). November, 1924.

A new cause for the infertility of certain lands has been discovered. This cause is impermeability to irrigation water. Such infertile soils are hard and dry a short distance below the surface even though water is held on the land for several days. This condition develops in some irrigated soils, which were formerly fertile. The soils are not deficient in plant food, but tend to accumulate alkali, since the irrigation water evaporates without percolation.

It was thought that the impermeability might be caused by deflocculation of the soil colloids produced by basic exchanges in which sodium and potassium of the irrigation water displaced calcium and magnesium from the soils. The soils were found to be high in calcium and magnesium and the ratios of divalent to monovalent bases in the irrigation and drainage water were not such as to strongly support this hypothesis.

Sodium chloride, sodium sulphate, and sodium silicate caused soils to become practically impermeable. Aluminium sulphate, tannic acid, calcium acid-phosphate, magnesium sulphate, manure, and gypsum were found to assist the penetration of water into the impermeable soil. The respective efficiencies of these materials, when one-half of one per cent. (one per cent. of manure) was mixed with a one foot column of the soil of low permeability, are represented by 4, 15, 17, 20, 22 and 23; where 36 represents the number of hours in which a one foot column of the untreated soil took in the first six inches of water. The maximum permeability obtainable with aluminium sulphate required between 0.5 and 1.75 per cent. of aluminium sulphate for the four soils studied. Very small amounts of aluminium sulphate caused marked improvement in permeability, indicating that impermeable soils may be profitably improved by treatment with aluminium sulphate. The increased permeability secured by aluminium sulphate was proved to be practically permanent. Aluminium sulphate up to 2 per cent. was not toxic when mixed with the soils studied, but became insoluble, displacing calcium as sulphate and bicarbonate.

After a five month's irrigation test the soils treated with aluminium sulphate had a porosity suggesting that gas might have formed in the soil and subsequently left in solution in the percolating water. The loosening effect of aluminium sulphate may be mechanical, similar to the baking powder reaction in the making of bread. The persistence of adsorbed air was found to be a factor in causing the impermeability of some dry soils. The cementing effect of calcium carbonate and other materials in solution in the irrigation water, where the soil moisture diminished to a very low value, was another factor contributing to the impermeability.

The study of permeability is being continued. X.

Erosion and Surface Run-off Under Different Soil Conditions.

DULEY, F. L. and MILLER, M. F. *Missouri Agricultural Experiment Station. Research Bul. No.* 63, pp. 50, 1923.

Seven plots, each one-eightieth of an acre in area, were laid out on a phase of the Shelby loam soil. The slope of the land averaged 3.68 feet per hundred. At the lower ends of the plots were concrete tanks for collecting the run-off and eroded soil, which were determined after rain. The results of these experiments showed that grass or clover land absorbed much more water than cultivated land. Deep plowing (8 inches) was only slightly more effective than shallow plowing (4 inches) in preventing run off and erosion. The surface inches of rainfall absorbed by uncropped land, or land in a cultivated crop like corn, was practically constant from year to year, even with considerable variation in the annual precipitation. The character of the rainfall largely determined the amount of soil erosion. A heavy rain was observed to remove more soil within a few hours than was lost during a whole year when the rainfall was well distributed. The loss of important nutrient elements from the soil through erosion may often be more serious than the loss through the removal of crops. The use of a cropping system that includes sod crops a considerable portion of the time, is the most practical means of reducing erosion on rolling land.

AUTHORS.

Methods of Investigation of Soil Moisture.

KACHINSKY, N. A. 2 Ed. Moscow, 1924.

The soil as a body created by several natural processes, is composed of separate, more or less strictly differentiated parts or genetical horizons, and sub-horizons differing in their physical and chemical structure. The regulation of moisture properties depends, besides other factors, upon physical, chemical and other properties of the soil, inasmuch as these properties are different in separate horizons or even sub-horizons. The moisture will be more or less individualized in them. Therefore it is expedient to investigate the moisture regulations of the soil and its other properties according to the separate genetical horizons.

It may be supposed that in separate genetical horizons moisture must vary slightly and change gradually, and vice versa, in passing to the next horizon the change might be more drastic. This can be proved by observation. The following table No. 1 shows clearly that fluctuations of soil moisture are greater between different horizons, than between measurements belonging to the same horizon.

Date of observation	Depths of genetical horizons of the soil						
24-XII-1922	A_2-26cm.	A_2-36cm.	B_1-39cm.	B_1-50cm.	B_2-54cm.	B_2-73cm.	B_3-76cm.
	5.6%	5.0%	9.1%	9.3%	11.0%	12.2%	13.8%

This is particularly evident in relation to moisture when estimated for every cm. of soil depth. It appears that fluctuations in the upper horizon of sandy clay soil of a woodland soil are about 23 times less than in passing from this upper horizon to the next sub-horizon of the first condensation (B_1). Likewise the fluctuations in B_1 are 20 times less then when passing from B_1 to B_2. Finally, for the two last sub-horizons (B_2 and B_3) this relation is 9.

The same kind of fluctuations, according to genetical horizons, are shown in their moisture equivalents.

It is evident that one has to study soil moisture along genetical horizons.

The maximum hygroscopic qualities and the moisture equivalents of soils change also rather abruptly according to separate genetical horizons. As both those properties serve as tests for valuation of the observed absolute data for soil moisture as to its utility for plant growth, we have to value these absolute data separately for each sub-horizon. This valuation might change the whole picture of moisture distribution, as the valuation might seem to have been made out according to the absolute data only.

Therefore, it must be assumed, that data for soil moisture, especially those concerning soils, strictly differentiated into their genetical horizons, have been obtained and arranged according to the generally recognized methods, without reference to the properties of separate genetical horizons.

The investigation on the vigour of the spreading capacity of the root system of rye, oats, and grasses, according to the different genetical horizons and sub-horizons of a sandy clay soil (of a woodland soil) shows that although the depth of the root system may be more than one metre, the chief mass of roots (about 90 %) is concentrated in the upper arable strata.

In reconciling this fact with observations of soil moisture on field plots occupied by those plants it must be pointed out that soil moisture is used by the roots of plants up to the full depth able to convey moisture by capillarity, but primarily the upper arable strata are exhausted of moisture. If the soil is subsequently moistened on the surface, a dry stratum can remain at some depth, whereas this depth and the extent depend upon previous drying and upon the amount of subsequent atmospherical precipitation. AUTHOR.

Soil Chemistry:

Chemical Properties of Soil.

BERTRAND, G. and MOKRAGNATZ, N. Sur la présence générale du Nickel et du Cobalt dans la terre arable. *Annals of agronomical science*, May-June, p. 167 to 171. 1925.

The authors have found from 5 to 39 mgm. of nickel and from traces up to 12 mgm. of cobalt in the soils of France, Germany, Italy, Denmark, Serbia, Rumania, independent of their geological origin.

Granitic sands appear to be the poorest.

The ratio Nickel to Cobalt, is generally from 3 to 5, but varies irregularly from 2 to 8.

PIERRE LARUE (*Gurgy sur Yonne*).

Determination of Phosphoric Acid.

BOISCHOT, P. Influence des sels de calcium sur le dosage volumétrique de l'acide phosphorique, *Annales de la Science agronomique*. May-June, pp. 199-202, Paris, 1925.

The quantity of free H_3PO_4 can be determined in liquids containing mineral acids, even in the presence of lime salts, by titration with alkaline liquid, using helianthine and phenolphthalein.

Helianthine will indicate the quantity of alkali necessary to saturate the strong acid, plus that necessary to saturate the first acidity of H_3PO_4.

The change to phenolphthalein will indicate the quantity of alkali required to saturate the strong acid, plus that needed to saturate the H_3PO_4.

PIERRE LARUE (*Gurgy sur Yonne*).

The Chemical Nature of a Colloidal Clay.

BRADFIELD, D. *Missouri Agricultural Experiment Station, Research Bulletin* No. 60, pp. 60. 1923.

The fresh subsoil of Putnam silt loam, the predominating prairie soil of North-East Missouri, was suspended in five parts of water by stirring, the coarser material settled by gravity and the finest colloidal material was separated by means of a centrifugal force of about 30,000 times gravity. This fraction was unusually high in Al_2O_3 and Fe_2O_3, almost all of which was soluble in hot HCl, which indicated that the colloidal fraction might be made up largely of the completely broken down end products of weathering, viz., colloidal Al_2, O_3, Fe_2O_3 and SiO_2. A synthetic mixture of these colloids having a chemical composition similar to the natural colloid was prepared and the physico-chemical properties compared. Cataphoresis studies showed that the natural colloid was negative and that the synthetic mixture was positive. The migration velocity of the natural colloid was decreased by traces of acids and increased by traces of alkali; larger amounts of alkali caused flocculation. In no case was the direction of migration reversed. The synthetic colloid had a much stronger buffer action than the natural colloid, due apparently to its high content of free Al_2O_3. The natural colloid was flocculated most readily by polyvalent cations in an acid medium. The synthetic mixture was more sensitive to polyvalent anions and to alkalis. Analyses were made of the fractions of each colloid soluble in dilute acid, and in dilute alkali. The differences were marked throughout. All data obtained indicated that the natural colloid was a complex alumino-silicate, rather than a mixture of the separate colloidal oxides.

AUTHOR.

The Examination of Peat Materials.

DACHNOWSKI, A. F. (Bureau of Plant Industry, United States Department of Agriculture). *Journal of Agricultural Research.* Vol. XXIX, No. 2, pp. 69-83, bibliography. Washington, D. C. 1924.

During the past few years investigations have been made regarding the different kinds of peat, and their position and arrangement relative to one another in different parts of the country.

From the results so far obtained it is concluded that an adequate description of peat land must recognize: (*a*) the differences in type of plot and the profile deposition of the material; (*b*) the water level in relation to the surface zone of oxidation and the lower zone of reducing action; (*c*) the nature of the subsoil and the water supply affecting the quantity and character of salts, such as lime, iron, sulphur, etc.

The results obtained with 20 different kinds of peat indicate the suitability of methods of foodstuff analysis for the investigation of qualitative differences in sedimentary, fibrous and woody peat materials. The value of these methods is limited, but they show that a close connection exists between the botanical and the chemical composition of the main groups of peat. The chief groups of organic compounds may be correlated with structural differences in the profile of peat deposits; the progress of the decomposition in drained surface peat soils may be followed, and the degree of chemical alteration taking place in the layers of peat below the water level may be determined.

The analyses show the wide differences in agricultural value of the several kinds of peat. W. S. G.

Removal of Lime from the Soil.

DEMOLON, A. Décalcification des sols. Laon, *Bull. Ass. d'Anc. élèves — Institut National Agronomique*, pp. 185-187. Paris, 1925.

Arable land loses every year from 600 to 1000 kg. of lime (CaO) per ha. Fertilizers, in particular slags, add lime but only in small quantities. The treatment of weeds with sulphuric acid increases acidity.

The treatment recommended is that with ground chalk in amounts of 800 to 4000 kg. per ha., rather than with free lime, the use of which causes the acid reaction to change to a caustic alkaline reaction.

From the physical point of view, lime and chalk have great capacity for flocculating clay, then come calcium nitrate, potash salts, ammonium salts and lastly soda salts. PIERRE LARUE (*Gurgy sur Yonne*).

Quaternary Alluvial Deposits.

DEMOLON, A. Sur la texture des limons quaternaires et des sols qui en dérivent. *Académie des Sciences*, meeting of 9 March, Paris, 1925.

This paper dealt with samples of clay from the North of the Oise at Montbrehain, Bohain, Bellicourt and Lequehart, lying on brick earth and then on ergeron to a depth of 120 to 150 metres.

The mechanical analysis by levigation (Kopecky method) is as follows:

	Sand 0.4 mm. to 0.2 mm.	Sand 0.2 mm. to 0.05 mm.	Silt 0.05 mm. to 0.02 mm.	Silt 0.02 mm. to 0.005 mm.	Clay from 0.005 mm.
Arable land	7.7	12.7	44	30.6	2.1
Brick earth	4.4	8.6	45.7	29.6	10
Ergeron	5.0	8.3	48.0	28.2	8.8
Red clay	3.0	10.2	46.1	31.8	7.2
Plastic clay	0.8	10.9	16.3	28.9	41.9

Plastic clay is Tertiary (Sparnatian). The origin of ordinary clay must be connected with this formation and not with the sands of Laon and Fère.

The washing out of lime from the surface layers of arable land has allowed the removal of clay. The plasticity of this soil is due, not to the proportion of plastic clay but to the large proportion of fine clays.

PIERRE LARUE (*Gurgy sur Yonne*).

Composition of Brick Earth.

DEMOLON, A. C. R. Sur la constitution chimique de la terre à briques. *Académie des Sciences*, Paris, 1925.

The author has compared brick earth and ergeron, belonging to the diluvium of the North of France.

He has found no difference, except perhaps in the colour and the proportion of iron oxide, which is respectively from 0.79 and 1.25 in brick earth, as against 0.45 and 0.90 in the underlying ergeron.

Limonite investing the sandy elements constitutes a stain which is fairly easily washed out by water.

There are no bases as in loess, no free aluminium, nor laterite formation. Hence, a simple phenomenon of the washing out of lime followed by oxidation of iron through atmospheric agency.

PIERRE LARUE (*Gurgy sur Yonne*).

Easily Soluble Calcium of the Soil in Relation to Acidity and Return from Liming.

DULEY, F. L. *Soil Science*, Vol. XVII, pp. 213-228, 1924.

Comparisons were made between the amounts of calcium present in different forms in soils and the results obtained in the field from applications of lime. No definite correlation was found between the calcium content of the displaced soil solution and the need for liming. This was due in part to the great variation in the soil solution under different con-

ditions. The calcium soluble in 0.04 N carbonated water, averaged only 553 pounds per acre in the soil from seven experiment fields in Missouri and Wisconsin, where good returns were obtained from liming. The amount was 810 pounds per acre as an average of seven soils that did not give good returns for liming. Since the average acidities of these two groups of soils were approximately the same, the soluble calcium seemed to be a more accurate index to the need for lime than the acidity. Soils of approximately the same acidity varied widely in their soluble calcium content. Marked increases for lime occurred chiefly on relatively infertile soils, but one infertile soil high in soluble calcium gave only slight returns from liming. The carbonated water extracted on the average 0.32 per cent. of the total calcium in the soils studied. AUTHOR.

Base Exchange in Soils.

HISSINK, D. (*Trans. Faraday Society*, see *Zeitschrift für Pflanzen Ernähr. und Düngung*. 4 A, 1925, 137 (Der Sättigungzustand des Bodens. A. Mineralboden (Jonboden).

Certain acid radicals are known to be absorbed by soil more readily than others. Treatment of soil by acid (I) removes absorbed bases, (II) may eventually destroy soil colloids, (III) only in extreme cases destroys structural minerals. Evidence is given in favour of removal of acid radicals, by formation of insoluble salts rather than by adsorption (RUSSELL and PRESCOTT). Only those radicals are removed which form insoluble salts with one or other of chief soil bases. The cycle of changes on adding a salt of one of these acids is, base exchange — liberation of free acid — formation of insoluble salt.

Experiments show that the oxalate radical is only absorbed in the presence of a high concentration of Ca. Soils previously extracted with HCl show no absorption, because insoluble Ca oxalate cannot be formed. Soil phosphates are more soluble in short time extractions of mineral acids than in 24 hour extractions.

The normal cycle of changes is, easily soluble phosphates dissolve in acid — sparingly soluble Fe and Al brought into solution later — precipitation of insoluble Fe and Al phosphates. The amount of phosphate absorbed by soil from a solution of Na_2HPO_4 in varying concentration of HNO_3 increases to a maximum and then falls off as the concentration of HNO_3 increases.

The effect of non-diffusible Al ion is shown by the distribution of H and anion concentrations in a system composed of soil in a diffusion capsule with dilute acid inside and out. H ion concentration increases outside and anion concentration inside. The same effect is produced with soil saturated with acid, with salt solution as a supernatant liquor.

On the basis of such observations, the toxic action of aluminium salts is explained as a result of high H concentration in the cell sap and high anion concentration in the surrounding soil, with consequent interference with the transpiration current and intake of nitrate, etc. T. E.

Absolute Capacity, for Air and the Degree of Acidity, of Forest Soils.

KNAPIL, K. and NEMEC, A. Sur la relation entre la capacité absolue de l'air et le degré d'acidité des sols forestiers. *Académie des Sciences*, Paris, 1924.

The nature of forest soils depends not only on the mother-rock, but also on the type of trees grown.

The authors made more than a hundred physical analyses in the forests of St. Markyta, Jindriche and Zavratec-Tremosnice in Bohemia, all on primary strata.

They determined the acidity by the potential hydrogen (inverse P_H) and the absolute capacity for air, that is, the total volume of the pores of the soil which, after saturation of the soil by water, still remain filled with air.

Amongst conifers: fir, spruce, pine, from 40 to 90 years old, the P_H varies from 4.5 to 5, and the air capacity from 14 to 38.

Amongst deciduous trees; beech, oak, ash, the P_H varies from 5.7 to 6.7 and the air capacity from 23 to 45 per cent.

In mixed plantations of deciduous and resinous trees, for example beech spruce, spruce and oak, intermediary figures are obtained.

The absolute air capacity of closely planted trees with non-deciduous leaves is lowest and decreases with the increase of acidity of the soil.

If the plantation is thinned out, the capacity becomes higher.

In the soils of deciduous forest plantations, the absolute air capacity is higher than for the fir and the spruce. The soils are less acid.

PIERRE LARUE (*Gurgy sur Yonne*).

Experiments on the Control of Wart Disease of Potatoes by Soil Treatment, with Reference to the Use of Sulphur.

ROACH, W. A., GLYNNE, Mary D. BRIERLEY, W. B. and CROWTHER, E. M. *Annals of Applied Biology* 1925, XXII, 152-190.

On light sandy soil contaminated with Synchytrium, it is possible to obtain a clean crop of a susceptible variety of potato by incorporating about 12 cwt. of ground sulphur per acre into the soil. On heavy soil up to 2 tons of sulphur per acre is required to destroy the fungus. These amounts are considered uneconomic on a field scale. P. H. H. GRAY.

The Injurious Effect of Excessive Liming on Podsol-Soils in connection with the Peculiar Character of the Biological Processes, taking place in such Soils.

TINLIN, A. *Transactions of the Institute of Fertilizers*, No. 26, p. 1-143 Moscow 1925.

In order to investigate the causes of the injurious effect of excessive amounts of lime introduced into the soil, experiments were conducted in 1923, in addition to those made in 1922.

Plant experiments were made with three different classes of soil.

(1) With a light loam soil, considerably deficient in bases, in which the injurious effect of excessive amounts of calcium carbonate has been demonstrated by the plant experiments of 1922.

(2) With a medium loam soil, near to the soil first mentioned, but containing more silty particles, with regard to the degree of saturation in bases. This class of soil was experimented with for the first time.

(3) With a heavy loam soil, somewhat deficient in bases where, according to previous experiments, excessive amounts or lime did not cause any injury.

The experimental work of the year 1923 was directed to the investigation of the same factors as the experiments of 1922. The products of biological processes were examined in the presence of different amounts of lime and without lime; the lime in this case was applied always in the form of $CaCO_3$. The products just mentioned are: ammonia, nitrates, nitrites, humus, soluble in water and lime, soluble in water.

In addition, the hydrogen ion reaction was accurately recorded.

The investigations were carried out in pots during the vegetative period of the plants (clover, mustard, vetch). The products, soluble in water, were extracted from beneath the plants, often at the beginning of the experiment, and more rarely later on. The extraction was made with water, and the washings were directly analysed.

The extraction of the products, soluble in water, was made as follows: — The pots had an opening at the bottom, which was covered with an asbestos disc, through which pure liquid could pass.

At certain intervals a number of these pots was watered from above, care being taken that the plants should not be injured. The quantity of water was calculated so that one-tenth part of the soil by weight was extracted and transferred to a special receptacle, from which the drainage water was taken for analysis. In addition to the series of experiments bearing on the question as to the effect of different amounts of lime, other experiments, were conducted. In one of these series of experiments the main object was to discover the effect of ammonia. In this case, the salts of ammonia were introduced into the soil in the presence of 1 % of lime as well as without lime, in order to trace the connection between the high concentration of ammonia and its injurious effect. Such a connection seemed to have been demonstrated by our experiments of 1922 (these experiments showed also large amounts of nitrites in the washings).

In this case also, account was taken not only of the decrease or the increase in crop yield, but also of the products obtained by the analysis of the drainage water.

Further, in a third series of experiments, investigation was made as to the influence of other cations upon calcium, in the case of injurious effects. In order to balance the exclusive effect of calcium, we have so far experimented with potassium and sodium on the basis of past experiments with potash, large amounts of which did not produce any injury (according to the experiments made in the laboratory of PRIANISHNIKOW).

Further tests were made with a view to the investigation of those crit-

ical periods during which the washing has proved to be very useful in the elimination of injurious effects.

We also studied during the summer of 1923 those periods at the end of which the sowing of seed on an excessively limed soil would not be followed by injurious effects.

The results of this experimental work may be summarised as follows :—

(1) From the three soils tested, an injurious effect after the application of 1 % of $CaCO_3$ has been noted only on a light sandy loam soil (more strictly speaking there was a decrease in crop yield only in this case) ; on heavier soils the same proportion of lime did not cause any injury.

(2) In agreement with the above, biological processes were much more active in a light soil with 1 % of lime than in a heavy one. The analysis of the light soil in its first stage (the first two or three weeks) showed a considerable accumulation of ammonia, of nitrites, of nitrates, of humus soluble in water and lime and soluble in water ; while in other soils, where no injurious effect was ascertained, the liming did not bring about any marked increase in the amount of these products.

(3) A highly alkaline reaction (PH = 7.8) was noticed not only in a light soil with 1 % of lime, where ill effects were noticed, but also in a medium loam soil with the same amount of lime, where no injurious effect was produced. Thus, a given amount of alkali does not in itself cause injury.

(4) Increasing the concentration of ammonia where 1 % of lime is present, by adding 0.1 % and even 0.15 % of chloride of ammonia, by weight, to the soil, retarded the growth of the plants. Thus the presence of ammonia was found to be of great importance with a given amount of alkali. Without lime, by a neutral, or better still by a lightly acid reaction, the salts of ammonia alone did not act injuriously upon the growth of plants, but rather increased the yield.

(5) By washing pots containing retarded plants, their growth was improved when the washing took place in the course of the second and third week from the beginning of biological life in the soil after the application of lime. This special period is characterized by a very active accumulation of ammonia, which was thus removed by washing at the proper time. According to the experiments of 1923, an earlier washing (first week) or a later one (after the lapse of four weeks) could not rectify the injurious effect.

(6) The results of the experiments with washing, were in accordance with the results obtained by the experiments with seeding after a lapse of 4 weeks from the beginning of the experiment, namely in that period, when the total amount of ammonia and of nitrites was already transformed into nitrates. This second sowing of clover, made later in a light soil with 1 % of lime, did not exhibit any signs of reduced growth of the crop, whereas the first sowing (made in the beginning of the experiment) gave a marked decrease in the yield.

(7) The addition of bicarbonates of potassium and sodium to 1 % of lime, eliminated the injurious effect when the total amount of these

salts did not exceed 0.05 %. The analysis was not made in this case, because of the sustained coloring of the washings.

(8) Small quantities of lime, not exceeding 0.2 % did not bring about any decrease of yield on the same light soil, on which there was reduced growth of plants after the application of 1 % of lime. The amount of the products of biological processes, especially the amount of ammonia, was found to be much smaller in this case than after excessive liming.

(9) The accumulation of nitrites, noted in 1922 in the case of a marked retardation of plant growth, brought about by excessive liming, was not recorded in 1923, when the decrease in crop yield was also less marked than in the previous year.

(10) Different kinds of plants do not exhibit the same degree of sensitiveness to the injurious effect of excessive liming. Besides, this sensitiviness is dependent upon the age of the plant, being very great in the early stages, of its growth and becoming less pronounced in a more advanced period of its life. AUTHOR.

Liming of Soils in France.

Enquiry on liming and the best methods of developing this practice.

Enquête sur le chaulage et les moyens propres à développer la pratique de cet amendement. *Bulletin du Ministère de l'Agriculture* (Office des Renseignements), 5 pp. May, July, 1925. Paris, 1925.

REGION I: NORTH.

Département du Nord. — The silts and clays of Flanders are poor in lime, the percentage being 0.5 to 2.5 per cent. Little liming is done.

Pas-de-Calais. — The Jurassic clays of the Bas-Boulonnais, the siliceous clays and the alluvial soils of the plateaux are deficient in lime. The marine alluvial soils of the Calaisis (the Watringues) have adequate lime. Marling is no longer done as before with chalk.

Somme. — Lime everywhere in the sub-soil: marly loams. In the Arménois, chalky plateaux. In the Santerre, plateau clay from 6 to 8 metres in depth: friable soil suitable for beets, with at least five per cent of lime.

Vimon et Ponthieu. — Siliceous clay, red, poor in lime (5 %), more or less covered over with plateau clays.

Marquenterre and Bas-Champs. — Sandy marine alluvial deposits containing less than 2 per cent. of lime.

All the valleys of the Department of the Somme are peaty.

Aisne. — Clays, brick earth, ergeron, red clay of the Vermandois, and of the Soissonais: the argillaceous soils of the Marlois, the Vervinois, the Tardenois, or three-fifths of the lands under cultivation with industrial crops in the department, an area of 350,000 hectares, are only slightly or not at all calcareous.

Marl is supplied from the chalk or limestone lying immediately below.

Oise. — The less calcareous regions are :— 1. Valois, 2. Moyonnais, 3. the east of the Picardy plateau which is covered with clay or with flinty clay on the South. The lime content is from 1 to 4 per cent.

Seine et Marne. — Proportion of lime according to the geological strata.

Eboulis : 0.3 to 13 : average 1 to 2 per cent.
Recent alluvial deposits : 1.9 to 25, average 8 to 12 %.
Plateau clay : 1 to 8, average 2 to 3 %.
Fontainebleau sand : 0.1 to 2, average 1 %.
Mussel clay and marls : 0.2 to 4, average 3 to 5 %.
Green clay : 0.9 to 67, average 15 %.
Champigny travertine : 1.5 to 39, average 9 to 10 %.

A basin of Jurassic soils and clays, all grass land, and without lime.

Seine Inférieure. — The majority of the soils of the country of Caux, chiefly flinty clay, only contain 3 to 5 % of lime. Chalk is extracted from under the clay.

Eure. — Even the alluvial plateaux of Neuburg and Voxin are overgrown with sorrel, an index of the absence of lime.

Calvados. — The Bocage district : granite, sandstone, schists with proportion of lime 0.04 to 0.3 per cent.

Cacu Champaign. — Clays on Jurassic calcareous rock, 0.5 per cent.

Pays d'Auge : flinty clay and plateaux clays 0.4 per cent.

Manche. — The territory of the department includes 80 per cent of Archaic rocks, 10 per cent. of Trias and Lias, 2 % of Cretaceous formation and 5 % of recent alluvial deposits. The silts however cover the greater part of the primary rocks and contain 4 % of lime. The lime is only sufficient on the Lias and in the polders in the Bay of Mont St. Michel.

Orne. — I. Soils very poor in lime. Norman Bocage : granite traversing the Pre-Cambrian. Armorican sandstone, May sandstone, schists yielding flinty clays, or acid silico-argillaceous rocks.

Pays d'Houluce: Vire granite and mica schists.

II. Soils or strata poor in lime. — Flinty clay on Cenomanian chalk, Perche sands, Jurassic strata with lime washed out, blue clays of the Callovian formation, ancient alluvial soils and clays.

Region II : East.

Ardennes. — Primary formation, Devonian, Silurian : quartz sandstone, schists, slates, heaths and birch forests and pasture land, poor in lime : 35,000 ha. Turonian and Senonian chalk rich in lime : fertile cereal land : 100,000 ha.

Lying between the two : Jurassic strata, 25,000 ha. with a band of Albian Greensand, wooded sandstone, etc.

From the point of view of richness in lime considerable variety exists in this districts.

Marne. — Chalk is dominant except in the East (Porthois, Argonne), and in the West (Brie, Tardenois). The lime requirements are very small,

as the bare chalk covers two thirds of the department and a part of the remainder is wooded, but everywhere calcareous.

Aube. — Natural regions. Upper Jurassic 'Vignoble' containing up to 50 per cent. of calcareous material.

Lower Cretaceous, moist meadow land, calcareous soils, oyster-bed marls, coloured sands (140,000 ha.). The moist lands would profit by burning the lime of the calcareous soils.

Champenoise Chalk (280,000 ha.), forms the *Champagne pouilleuse*, which continues into the Marne: produces cereals and in particular brewing barleys.

Nogent Eocene, the different cultivated lands of la Brie, amount of lime adequate.

Flint-Clay of the Othe district, poor in calcareous material, can be marled with the substratum of chalk, if not wooded.

Valleys of the Aube and the Seine, alluvial gravels, poor for the most part in calcareous material.

Haute-Marne. — Completely occupied by secondary formations, chalk excepted.

Trias poor in calcareous material in its lower stratum, coloured sandstone. Rich in Muschelkalk of limited area, fairly rich in Keuper marls with 6 to 9 per cent. of chalk.

Lias. — Bassigny and oolitic strata rich in chalk, except for a few ferruginous beds. Light soils on the whole suitable for sainfoin.

Oxfordian Marls formerly cultivated in vines.

Corallion and Portlandian, dry, sometimes with the lime washed out, but poor.

Neocomian, fertile, calcareous, except at the base which yields marl.

Albion. — Greensands and clays, often wooded, always poor in lime.

Alluvial soils with adequate lime, as they come from Jurassic strata.

Haute-Saône. Primary formation occupies three cantons out of 38.

Trias without calcareous material or with lime washed out, except in the Keuper marls, occupies 7 cantons.

Lias extends over 7 cantons. The Lower Lias alone is deprived of lime.

Oolitic limestone occupies 9 cantons with lime content variable. The Tertiary is limited to 3 cantons where silica is dominant.

Moselles. — I. Northern Vosges, light siliceous soils, poor in lime: grows rye and potatoes.

II. Lorraine plateau, Triassic calcareous clay with lime kilns.

III. Liassic superstrata in limestone plateaux.

IV. On the left bank of the Moselle, the edge of the Woevre Jurassic formation is limestone.

V. The alluvial soils of the Sarre are siliceous. Those of the Niode, the Seille and the Moselle are friable soils, fairly rich in lime.

Meuse. — Department entirely Jurassic: the banks of the Meuse and the Barrois in particular are of limestone formation.

The Argonne and the region of the Woevre have in particular undergone loss of lime.

Meurthe et Moselle. — I. Vosges Mts., Vosges sandstone and variegated sandstone, not calcareous.

II. Lorraine Plains. Flinty alluvials of the Moselle and the Meurthe. Muschelkalk, Keuper marls and Lias with sufficient lime.

III. Oolitic plateaux with lime removed, and ferruginous.

IV. A quarter of the cultivable lands in the Department of Meurthe would benefit by liming.

Vosges. — The non-calcareous soils predominate.

La Montagne. Arrondissements de St. Die and Remiremont, i. e. 210,450 hectares; granite or Permian Sandstone.

Lime content always lower than 1 per cent., but much wooded, 41 per cent. forest.

Vôge: 102,993 hectares. Variegated sandstones, containing up to 0.6 and 0.8 % of lime. Very wooded: 29 % forest.

Alluvial soils of the Moselle: 6,000 hectares.

224,000 hectares in mountain and 73.000 hectares in the Vôge might be treated with lime as arable or grass land, but not more.

Bas-Rhin. The- Vosges are crystalline rocks with little lime. Keuper sandstones with varying lime content.

Plain of the Ill and the Rhine. Lias marls. Loess with 10 to 30 per cent. of lime. Gravel poor in lime.

Haut-Rhin. — Vosges crystalline rocks not calcareous.

Foot-hills of the Vosges often calcareous (Muschelkalk and Keuper).

Plain of the Ille and Rhine. — Diluvium or gravel. The arable land is less rich in lime than the sub-soil.

Sundgau. — Loess, the lime similarly removed from the surface, as also in the Jura.

Belfort. — Vosges granitic, igneous and schists without lime. Foothills of the Vosges: Permian sandstones and Vosges sandstone without lime.

Jurassic escarpment and Callovian. Oxfordian plateau Rauracian and Sequanian, calcareous.

Small Tertiary Tongrian (Oligocene), with lime removed from surface, marls to some depth.

Alluvial soils with no lime.

Region III: West.

A. *Brittany and Vendée.* — Region of primary strata, granite and gneiss and primary rocks, schists and sandstones.

Mayenne. — The geological outcrops of calcareous rock are staked out by the kilns and the lime made in these is sent all over Brittany for amendment. There is a strip of carboniferous limestone from the sur-

face of which the lime has disappeared so that it now contains less than five per thousand of carbonate of lime : next, the Jurassic strip. The 300,000 hectares which could profit by liming on an average application of 300 kg. per annum, or 90,000 tons, only receive 4,450 tons.

Three methods of applying the lime are in use : beds or large heaps near the field ; small heaps covered with earth, which is the so-called English method ; spreading the lime in the form of powder by means of a fertiliser distributor.

Marne et Loire. — The eastern part of this Department is of Tertiary formation of variable character. The western part, beginning from Angers, consists of schists with folds of carboniferous limestone, largely worked where crossed by the valley of the Loire. The lime kilns of Montjean in particular supply Loire Inférieure.

Ille et Vilaine. — This Department only contains two outcrops of Tertiary calcareous soil. Composts in " beds ", piles of mould, ditch slime, dead leaves and lime are prepared, and from 3000 to 5000 kg. per ha. of these materials are spread every six years.

Côtes du Nord. — Only two calcareous beds. Sand is pumped from the bottom of the sea and sent inland as far as 100 km. from the coast.

Finistère. — The average content of lime on the arable land is only one per thousand, varying from 0.6 to 2.5 per 1000. It would be possible to use with advantage 400 to 500 kg. of lime per ha. per annum.

On the much indented coast use is made of sand containing shells, and tangue combined with wrack. As a result as well as on account of the total absence of frost in winter and the favourable effect of damp climate on early products, a belt of fertile soil (golden belt), worth as much as 50,000 francs per ha. is obtained.

The sands collected at low tide contain from 1 to 85 per cent. lime. From 4000 to 5000 kgs. per ha. are used every four years. The amount of lime imported from Mayenne is between 2000 and 2500 kgs. every four years.

Morbihan. — The strata only contain traces of lime. Between 300 and 500 kgs. would be needed on each of the 450,000 ha. under cultivation. Imported lime is applied to crops of potatoes and winter cabbages at irregular intervals and in amounts varying between 1000 and 1500 kgs. per ha. Calcareous sands are used on the Atlantic coast at Trinité, Belle-Ile, Ploemeur, Locmiquélic, Pouldu, which contain from 58 to 84 per cent. lime.

Loire Inférieure. — The amount of lime in the soil is only between 0.3 and 0.5 at most. It is quarried on the Carboniferous Limestone of Erbray and imported from Montjoan, generally as material of 90 per cent. purity (CaO). Out of the 570,000 ha. of soil, meadows and vineyards, barely 21,000 ha. are limed.

Vendée. — Vendée is formed chiefly of the " Bocage " of ancient rocks, bounded on the South by a fringe of Lias and bog. Three-fifths of the department have had to await the construction of roads in the XIXth century for the cultivation of wheat, clover and lucern to be

made possible by the use of lime and phosphates. At the same time the size and weight of animals increased.

B. *Poitou. Deux-Sèvres.* — The lines of lime kilns follow the calcareous layers of Jurassic or the North-West, South-East and South of the Department.

Liming ought to be extended over three quarters of the districts of Brossuire and Parthenay which constitute the prolongation of the "bocage" of Vendée or Gâtinais, and in addition over the Oxfordian marls of the South of Niort and Lozay which rest on a calcareous rock called Egrain or Chiffe, or Pierre Chauffante. The schistous marls of Rauratian or Sequanian should be marled in moderation rather than limed. The ferro-argillaceous red soils with flints of Poitou should be limed, as also the sands and green clays of the Cenomanian of Louzy, which should be marled from the Tertiary beds cropping out in the Valley of the Thouot and given 50 to 65 per cent, carbonate of lime; the variegated sands and clays of Upper Eocene; the terraced slopes of the plateaus of the Poitevin defile so far as they are not wooded: *moor* land similar to the landes covered with heath, ferns, gorse, broom, etc., the peaty valleys.

In the neighbourhood of St. Maixent and la Mothe Heraye, a marl containing 70 to 90 per cent. carbonate of lime, is found at a depth of 50 to 70 cm.

Lime applications are made in inverse ratio to the proportion of humus, that is to say from 2 to 5 cubic metres every five years. Autumn liming is performed in small heaps of 15 or 20 kg., spring liming by distributing the large heaps of compost built up in autumn at the top of the fields and broken down during the winter. The ground lime of Airvault is now coming into use with fertiliser distributing machines.

Vienne. — Out of the 300 communes of the Department, 160 have soil poor in lime. The system of métayage on short leases does much to prevent the use of lime dressings which are especially necessary in the district of Montmorillon.

District IV: Central.

Central part of the basin of the Loire. South of the Parisian basin. Tertiary in the North; Jurassic in the South.

Allier. — The Miocene cropping out in the valleys are the only strata rich in lime. Their total area is 10,000 ha. out of 417,000 ha. of arable land. Either from 140 to 160 hl. of lime grit are scattered every 15 or 20 years or else from 35 to 40 hl. every five years. This process gives opportunity for the use of fertiliser distributors.

A. *Berry. Cher.* — The South of the Department comprises 55,500 ha. of granite, gneiss and Triassic sandstones. The North 140,000 ha. of clay with flints and Tertiary clayey sand of Sologne. Lying between the two, the Jurassic strata provides lime. Oyster beds cropping up in the valleys underneath the clay with flints provide marl. There is a tendency to use ground lime in order to save manual labour.

Indre. — The Tertiary clayey sands of Brenne and the granitic soil of Boischaud, with no lime, represent more than half of the Department and are separated by Jurassic chalk. Marling has been abandoned. Liming is still carried out at irregular intervals at the rate of 2 or 3 m^3 per ha.

B. *Touraine.* — Crossed by the Loire.

Indre et Loire. — Three-fifths of the Department are formed of sandy-clay soil. The plateaux are often covered by flinty clay («Bournais" soil). The calcareous layer of Brie at one time provided marl. Shell marl or Tertiary shelly sand are chiefly found on the plateaux of Manthelan, Bossée, Louans, Savigné, Courcelles, St. Laurent.

Loir et Cher. — Four fifths of the Department, in particular the Tertiary clayey sand of Sologne in the South and the Secondary sands and clays of Perch in the North should be amended. On the calcareous layer of Beauce there is also "worn out" soil which the use of lime has restored to intensive cultivation. Lime grit for slaking is put in small heaps or else powdered lime is spread by the fertiliser distributor at the rate of 1200 to 1500 kgs. per ha., over land lying fallow prior to the growing of corn.

Marl or chalk are used at the rate of 25 to 60 m^3 per ha. About 20 lime kilns are to be found in the Department.

C. *Orléanais.* — Tertiary and Cretaceous strata predominate.

Loiret. — Beauce is calcareous. In the North Gâtinais consists of chalky slopes, covered with flinty clay and often wooded. Puisaye and Berry contain clay with flints covering the calcareous or ferruginous sands and clays of the Lower and Middle Cretaceous.

Orléanais properly so called consists chiefly of sands, covered with woods.

To the South of the Department is the edge of flinty clays of the Sologne to which enormous quantities of marl from Blancafort have been applied.

D: Bourguignon-champenois borders. *Yonne.* — The Department of Yonne forms the transition between the granite of Morvan and the chalky plateaux of poor champaign land, which are covered with flinty clay.

It is traversed obliquely by the sands and Albian ferruginous clays of the moist champaign land which are often covered with trees. These three zones are separated on one side by the strip of the Burgundian calcareous Jurassic and on the other by the Cenomanian, Turonian or Senonian marly clay. To the South, the Morvan which, moreover, is itself much wooded, uses the lime of the Lias, rich in phosphates.

In the North, the plateaux bordering on Gâtinais use chalk, often with phosphates, and reduced to powder. Marling has been given up. The amount of lime applied is at the rate of 30 to 40 hl. per ha. every 3 years.

V. District: Central Massif of France (Granite surrounded by Jurassic ou the West and by Primary Triassic and Tertiary on the South).

Department of Loire. Granites, schists and mica-schists are deficient in lime. It is only found in appreciable quantity in the Tertiary strata of the Basins of Forez and Rannais (Valley of the Loire).

Department of Puy-de-Dôme. Three parts : (1) Granite substratum of Forez, Livradois and Combrailles, *i. e.* 500,000 ha. representing 5/8 of the surface of the department. (2) Volcanic Chain of Puys and Mont-Dore, 100,000 ha. (3) Valley of the Allier (Limagne), comprising another 50,000 ha. of soils poor in lime, in all 650,000 ha. of which 220,000 only are cultivated.

A suitable addition of lime is admitted to be 1200 kgs. per ha. per year, that is to say 270,000 tons ; the tenth part only of this is in use nowadays. Lime is brought partly from the Department of the Allier, and costs about 100 francs per ton at the arrival station.

Department of Cantal. The Oligocene Chalks and marls have escaped erosion precisely where they meet the granite and the volcanic formation. Lime amendments are coming more and more into use in this district in contradistinction to the rest of France.

Department of Haute-Loire. Continuation of the Granite and the Volcanic formation of Auvergne. Soils containing more than 2 per cent lime are there an exception. The local chalk is only 75 per cent CaO, and is now not much used.

Department of Lot (Quercy). No liming is carried out either on the granites and schists which occupy 100,000 ha, or on the Lias (30,000 ha.) or on the rich alluvium of the Lot and the Dordogne.

Department of Aveyron. Aveyron comprises three districts : the granitic and schistous *Segala* (etymologically : rye soil) ; the "*rougier*"-red Permian soil, poor in lime, and lastly the *Causses*, chalk Jurassic plateaux often with the lime removed from the surface.

Out of a total of 437,000 ha. of cultivated land, 300,000 would profit by liming, at the rate of a minimum of 500 kilograms of lime per ha. and per year.

Liming is in fact effected at the rate of 15 to 20 hl. of lime every six years, on light soil. The amount is double on heavy soil. "Composts", or mixtures of vegetable debris and lime, are also prepared.

Department of Lozère. Includes both granite formations and the calcareous "causses". Owing to the altitude, the cultivation of this district is not intensive and transport of lime is laborious.

Department of Tarn. Comprises the East of the carboniferous strata which produces coal for the burning of lime. On the West are Tertiary soils.

Liming is accompanied by a good dressing of manure to prevent the "burning" of the ground and is carried out for clover, sainfoin, lucern. for cereals and for potatoes. The strata which respond most to lime are the primary schists, clay with Tertiary gravel and ancient alluviums, both fine-siliceous and "battantes", that is to say heaped up and known as "boulbènes".

Out of 200,000 ha. of cultivated land in Tarn, 150 000 would be benefited by liming.

Department of Nièvre. — The East of the Department is occupied by granitic Morvan (Cantons of Château-Chinon, Montsauche, Luzy, Moulins-Engilbert), and schistous Morvan (Millay, Luzy). The siliceous strata contain little lime.

Bazois and the district of Clamecy are partly occupied by fertile chalk Lias, then by Middle and Upper Jurassic which is calcareous and dry, though sometimes the lime has been removed, leading on through the clays of the Lower Cretaceous and the sands or Middle Cretaceous to end in the clays and sands of the alluvial deposits of the Loire at Cosue.

To the South of the Morvan strata, the Lias is again to be found at St. Saulgé, St. Benin d'Azy and Décize.

To the South of Nevers, between Loire and Allier the strata is siliceous-clay.

Out of 260,000 ha. of arable land, 100,000 ha. would profit by amendments and out of 800,000 ha. of natural meadows, from 10 to 15,000 ha. Lime is used from the kilns established on the Jurassic strata.

Department of Creuse. — Lime has revolutionised the cultivation of this district which is given up especially to root forage crops. These crops occur in rotation every 4 or 5 years and take normally 1500 kg. of lime per hectare, that is to say 70,000 tons (on about 46,000 ha. of hoed crops) coming from the kilns built on Berrichon Lias at the edge of the Granite zone.

Haute Vienne. — Upper Limousin, a stock raising district like Creuse, employing 500 kgs. per ha. on arable land.

VI. District: East Central.

Department of Côte d'Or. — Almost entirely occupied by Jurassic plateaux and the Tertiary and Quaternary plain of Saône. There is no want of lime except in the so-called pasture lands of Anxois, the fine sands of the Valley of the Saône and the soils of Rouget du Châtillonnais.

Department of Saône and Loire. — The siliceous argillaceous breccia of Louhans, the granite slopes of Maçonnais, Autunois, Charollais, the schists and sandstones of Chagny, lastly certain decalcified zones of Jurassic, are all deficient in lime.

The lime burnt at Creuzot is used in September or May, in small heaps covered over with earth, to the amount of 1000 kgs. per ha.

Department of Ain. — The districts of Nantua and Gex are situated in the Jura or on calcareous glacial formations.

The plain of Bresse is formed of argillo-siliceous soil derived from Tertiary sand and non-calcareous yellow silts or loam. The Dombes is a moraine, poor in CaO. Much lime has been used there, but the kilns are now extinct.

Department of Rhône. — The Rhône soils are chiefly granitic, with only a small area of Jurassic strata. The lime residues of the Lyons manufactures are employed as sufficient amendment.

Department of Isère. — The strata of Tertiary, Glacial or Fluvio-glacial origin of the lower cultivated area, as well as the upper valleys of Oisans in the high granitic Alps, are usually deficient in lime.

Department of Doubs. — Although situated in the heart of the Jura the soil requires lime on account of the washing of the lime out of the upper layers.

Department of Savoy and Upper Savoy. — The mountain heights (Mont Blanc) are of granite or schist and little cultivated. They are flanked on the West by the calcareous Prealps.

The plateaux are sometimes decalcified to such a degree that sorrel replaces white clover on Glacial formations and even on Mollasse.

The cultivation of sainfoin (*Onobrychis*) is decreasing.

Basic slags give better results than superphosphate on the glacial plateaux near the lakes of Annecy and Geneva.

There are kilns at Pont du Gy, Vovray, St. Roch, Saint Jeoire le Giffre, but the lime is used chiefly for the electric synthesis of calcium carbide, by the employment of the power of the high waterfalls.

Department of Hautes-Alpes. — Most of the cultivated land is in a chalk district. The valleys are irrigated. Those of Briangonnais and ancient alluviums could alone be amended to advantage.

VII. District : South-West.

Department of Charente. — The granite and schistous formation of the district of Confolens and the Tertiary strata of the cantons of Champagne Mouton, Ruffee, St. Claud, Mansle, la Rochefoucauld, Montbron, Baignes and Brossac, are covered with vegetation : heath, gorse, broom, chestnut, timber. 130,000 ha. of arable land require lime.

Marl is found in the Lias and in the Cretaceous formation, but lime would be more suitable.

Produce-sharing tenants bear a third part of the expense of buying lime but undertake the transport from railway station to field.

Department of Charente-Inférieure. — The soil is deficient in lime and consists of Tertiary strata, marshy fields and lagoons ; total 150,000 ha. requiring 4 cubic metres of lime per ha. There are lime kilns on the Jurassic strata of the two Sèvres and the Vendée.

Department of Gironde. — Eight-tenths of the soil are without lime : 400,000 ha. are Pliocene sand of the Landes, containing 82 per cent. silica, 10 per cent. clay and 8 per cent. humus.

The pine forest extends for 357,000 ha. and the Lande subsists where sandstone Ortstein is found near the surface.

Heavy, clayey, silico-clayey and silico-humiferous tertiary soil would also be benefited by lime.

Department of Landes. — The proportion of sand and of forests of sea pine is greater there than in Gironde. Marling and liming only affect the tertiary slopes of Chalosse and Armagnac which have various crops and soils ; Marl — 10 to 20 cubic metres per ha. every 5 or 10 years ; Lime — 1000 to 1500 kgs. per ha. every 3 to 5 years.

Department of Dordogne. — In the districts of Noutron and Ribérac, the produce sharing tenant pays for a third of the lime.

Department of Lot and Garonne. — In spite of the alternation of calcareous layers in the Eocene and Oligocene outcrops, lime is lacking in the alluviums of Garonne, Lot and Dropt, and of the plateaux, in the sands of

the Landes, in the soil of the valleys, that is to say over about half of the cultivated surfaces. Lime kilns, however, no longer yield rich lime.

Department of Gers. — Valleys separated by Tertiary plateaux covered over by Pyrennean siliceous strata: 45 per cent are deficient in lime. Much arable land is available, however, on account of the scanty population.

Department of Basses-Pyrénées. — Jurassic or Cretaceous strata covered over by Pyrennean diluvium or with the lime removed. The Miocene to the North of Gave du Pau is deficient in lime. Lime kilns at Montaut and Arudy, magnesian lime at Coarraz (Béarn) and Osses (pays basque).

Department of Hautes-Pyrénées. — Conditions similar to the preceding. It often happens that the content of the soil in lime is inferior to that of phosphoric acid.

Department of Haute-Garonne. Liming is carried on in the alluvium of the Garonne from Boussens to Toulouse and on the plateaux of Lauragais. The lime comes from Tarn or from Ariège.

Department of Tarn and Garonne. — One third of the total is deficient in lime. It includes the following: recent alluvium of Garonne and Aveyron (content in CaO lower by 5 %) ancient alluvium of Garonne and Tarn, among which is siliceous soil "battante" or "boulbine" while with quasi-colloidal silica and acid reaction; river gravels and plateau clay from Bruniquel to Montbauban; Molasse of Armagnac with the lime washed out.

Total 66,000 ha. out of 200,000 ha. of arable land of the Department.

Lime comes chiefly from Tarn, Bruniquel, Lexos and Suvillars.

Slaked lime is scattered in the fields in small quantities for lucerne.

Before growing cucumbers in an open field, ground chalk is applied. The amount is 1200 to 1500 kgs. of lime per ha.

Department of Ariège. — The plains cultivated over an area of 10 000 to 15 000 ha. between Mirepoix, Pamiers and Saverdun, as well as the Valley of the Salat, are covered by granite alluvium, and by Pyrennean schists and sandstones; they are therefore without lime.

PIERRE LARUE,
Gurgy sur Yonne.

Soil Biology.

The Bacterial Inoculation of Sugar Beet.

NEMEC, A. (Biochemical Institute for Plant Protection, Prague). Expériences sur l'inoculation de la betterave à sucre. *Annales de la science agronomique,* Year 41, No. 4, pp. 254-259. Paris, 1924.

Experiments have been carried on for some time past in the adaptation of the bacteria contained in the root nodules of leguminous plants to non-leguminous plants, and it has been noted that the success of the experiments largely depends upon the bacteria of the rhizosphere, or that part of the soil which is in immediate contact with the absorbent root hairs. These bacteria exert a favourable influence upon the penetration of the bacteria into the root hairs and hence upon the formation of the nodules.

The writer in his experiments used the BLUNCK method which is based on the principle of successive adaptations of the bacteria of leguminous plants to the juices of the roots of the plants which have been the object of experiment and of the heightening of their effect by means of repeated transmissions through the same plant. Experiments made on a large scale on this method have always given good results, the increase in the yield varying from 5.6 to 17 %. A negative result was shown only in cases where the yield of the non-inoculated control plots was at a maximum.

Hence bacterial inoculation provides a means of increasing the fertility of a soil up to the point of its maximum productivity. A. F.

Insect and other Invertebrate Fauna of Arable Land at Rothamsted.

MORRIS, H. M. *Annals of Applied Biology*, 1922. IX, pp. 282-305.

A method of taking soil samples for determining the numbers of Insecta, Myriapoda, Oligochaeta, Acarina, etc. present in the first 9 inches of soil is described, and the functions of this inverterbrate fauna discussed. Soil was examined at definite intervals during a year and the numbers present at different depths compared on each of two plots receiving widely different manurial treatments. Of 15 millions of invertebrates per acre on the plot receiving 14 tons of dung per acre annually since 1839, 2.47 millions were insects. The greatest number of all kinds of invertebrates occurs in the first 3 inches of soil. The greater number of invertebrates found in the manured plot does not indicate a greater increase in the number of organisms directly harmful to the growing crop. The larvae of Elateridae, Tipulidae, and Hepialidae occurred in equal numbers in the two plots. It is suggested that the great difference observed between the numbers of insects found in arable land and those found in pasture (reported in a previous paper by the Author), and the greater depth of penetration, is due to the better aeration and drainage caused by cultivation.

P. H. H. GRAY.

The Physiology of *Thiobacillus thioxidans* an Autrophic Bacterium Oxidizing Sulphur under Acid Conditions.

STARKEY, R. L. *Jour. Bact.* Vol. 10, pp. 135-163, 1925.

Physiological investigations were carried out with one of the non-filamentous true bacteria isolated from sulphur and soil-phosphate composts by Waksman and Joffe. It oxidizes sulphur and thiosulphate rapidly to sulphate, even under extremely acid conditions. Oxidation was most rapid in the early stages of the process following a short lag period of about two days. The decreased rate of oxidation is not apparently due to any attenuation of the organism, or to the accumulation of toxic organic metabolic products, but rather to the accumulation of sulphuric acid. In the presence of high concentrations of thiosulphate (3 per cent) sulphur becomes precipitated in the medium during growth, probably indirectly and not as a product of the primary reaction of the process. With sodium thiosulphate as source of energy, 50 to 65 parts of sulphur as thiosulphate became

oxidized to sulphate per unit of carbon assimilated. In the presence of 1 or 5 per cent. sulphuric acid, the economy of utilization of the available energy was lower than in the absence of appreciable amounts of acid. The ratio of sulphur oxidized to carbon assimilated was not appreciably affected by concentration of potassium phosphate, as high as 5.5 per cent. Growth was but slightly effected by small amounts of salts of heavy metals, reduced pressure, or following substitutions of precipitated or amorphous sulphur for the rhombic form. The organism responded readily to changes in temperature, moisture, and partial pressure of oxygen or carbon dioxide.

AUTHOR.

The Carbon and Nitrogen Nutrition of *Thiobacillus thioxidans* an Autotrophic Bacterium Oxidizing Sulphur under Acid Conditions.

STARKEY, R. L. *Jour. Bact.*, Vol. 10, pp. 165-195, 1925.

A continuation of studies on the physiology of one of the true sulphur bacteria was concerned with the effects of some carbon and nitrogen compounds on sulphur oxidation. Dextrose disappears from the medium during growth and there is a general correlation between the amount of acid produced and dextrose removed. This disappearance of dextrose was not due alone to the acid, the suspended cells in a purely physical way, or to exo-enzymes, and the organism cannot use dextrose in the absence of sulphur or some inorganic sulphur compound as a source of energy. It appears that dextrose may enter into the metabolism of the cells in the presence of sulphur as a source of energy. Citric acid inhibited growth at 5.0 per cent. concentration but not in the presence of 2.5 per cent.

Ammonium nitrogen is the only source of the element that has been found available to the organism. The presence of nitrates in even as low concentration as 0.05 per cent. KNO^3 depressed oxidation and 1.25 per cent. completely inhibited oxidation. The economy of utilization of the energy available as measured by the carbon assimilated per unit of sulphur oxidized was much lower in the presence of nitrate than in its absemce and the depression was greater in the presence of larger amounts of nitrate. It appears that the injury from nitrate is specific for the anion. Oxidation was inhibited in the presence of 2.5 per cent. of peptones and injury was marked at 1.25 per cent. Results indicate that neither urea, peptone, nor amino acids are available either as sources of nitrogen or carbon for the organism.

AUTHOR.

Seed Inoculation of Lucerne (*Medicago sativa*) and its Relation to Mobility of Nodule Organisms in Soil.

THORNTON, H. G. and GANGULEE, N. (Rothamsted Experimental Station). *Nature*, Vol. 114, No. 2878, pp. 932-933. London, 1924.

In their studies of the nodule organism (*Bacillus radicicola*), the method used by the authors consisted in making a suspension of a bacterial culture in a liquid, the suspension being used to wet the seed. There is evidence that after penetrating the root, the bacteria are unable to travel any

distance along it, hence, when the seed has germinated they must progress through the soil in order to reach various parts of the root system, where nodules are to be formed.

It was found that they will progress through light soil at the rate of about 1 inch in 24 hours. When a drop of water containing the bacteria in the rod stage is added to sterile soil, the organisms do not spread until after a considerable interval, which interval is less if the inoculum consists of a suspension in milk. This may explain the successful results obtained in Scandinavia where skim milk is used to make the suspension of bacteria employed for inoculating.

The authors tested the effect of inoculating sterile soil with a suspension of bacteria in skim milk containing 0.1 % $CaH_4 (PO_4) \cdot 2H_2O$, and found that the spread of the organism from the point of inoculation began almost immediately. On averages of 10 parallel pots, increases in nodule numbers of 93 % and 73 % were obtained in two experiments by the addition of phosphate to the milk. There was also a favourable effect on the yield the crop. W. S. G.

The Importance of the Concentration of the Hydrogen-ions of the Soil in the Formation of Plant Substance.

CHODAT, F. Sur la concentration de ions du sol et son importance pour la constatation des formations végétales. *Bull. de la Société Botanique de Genève*, Series II, Vol. XVI, pp. 36 to 143, Geneva, 1924.

The author shows the importance of the concentration of the hydrogen-ions for the biochemical and biophysical processes and the physiological function of the critical state of the amphoteric colloidial substances, a state which has received the name of the isoelectric point.

A relation may be established between the phenomenon of the curves of growth as a function of the reaction of the environment ; from investigations of this type it appears that the curves present two maxima and certain plants are proved to be entirely unsuited to soils with a definite reaction.

There is difficulty in classifying plants and plant associations into those requiring acids, those requiring neutral substances and those needing bases, until there is a clearer understanding of the corresponding reaction to the physiological neutrality, *i. e.*, to the iso-electric point of the plasmic tissues of the plant itself. It is thus convenient to substitute for the qualitative theories of "lime avoidance" and "lime requirements" that quantitative idea of range of accomodation to the reaction of the soil, in so far as the actual acidity of the soil has, in the greater number of cases, more influence on the distribution of the species of plants than the mineral components.

If, for example, we taken *Eupteris aquilina*, which has been always regarded as showing reaction to soils that are deprived of lime, it is seen that it can also thrive under other conditions, within a range of P_H from 5.5 to 7.6 and which therefore goes beyond neutrality. Contrary to current opinion, it is observed that marsh plant formations do not necessarily require an acid environment, although it is true that *Phrag-*

mitetum and *Scirpetum* belong to a group of formations which thrive in an alkaline environment.

The same values of P_H may however characterise soils carrying most varied plant associations : in this case the differences are determined by other factors, such as the geographical situation, the altitude, and climate. These formations differ among themselves in the strength of their vegetative growth and the specific type of their inflorescence and take the name of "homologues". Homology is displayed in a physiognomy special to these plant associations, a certain common element of floral type and a resemblance in the edaphic conditions.

This last characteristic makes it possible to classify the homologous formations into the acid type, passing from *Quercetum suberis* to *Ericeta varia*, *Calluneta*, to *Vaccinietum* and to the alpine tundra varieties, and the alkaline type which passes from *Quercetum ilicis* by degrees to the steppes on neutral and almost acid soil. To these two classes, the aquatic isomerous plants correspond: (A) wet moors, *Vaccinietum uliginosi*, *Sphagnetum* ; (B) *Alnetum glutinosae*, *Eupatorietum*, *Caricetum*, *Phragmitetum*, *Scirpetum*.

The author then examines the genesis of *Sphagnetum*, which must be considered as a parasitic formation, taking root because favoured by the acidity of the forest and the moor land, and may find its way from either habitat and invade the *Caricetum*. This progressive movement may be traced and an examination made of the reaction of the pools of bog water and of peaty earth : and it is thus possible to observe a horizontal stratification of P_H. Gradually as one passes away from the forest on to acid soil, one passes from a maximum acidity corresponding to the *Sphagnum* zone to diminishing P_H values and to the *Caricetum* with a distinctly alkaline reaction. The waters of the two formations differ as does the P_H, at one metre apart the variation may be from 4 to 7.3. In certain localities (Lossy), the alteration in the course of a brook with an alkaline reaction has resulted in the disappearance of *Sphagnetum* and replacement by *Phragmitetum*.

On virgin soils of non-calcareous moraines, the plants first making their appearance bring about acidification, which is transferred to the successors.

The *Quercetum roboris* of the glacial soils of the Canton of Geneva shows an acid reaction of the soil, which explains the abundance of *Lathyrus montanus* and the patches of *Calluna vulgaris*, *Teucrium scorodonia*, *Genista germanica*, *Potentilla erecta*, which were at first considered as colonies from other localities. A. F.

Soil and Vegetation.

The Effect of a Varying Supply of Nutrients Upon the Character and Composition of the Maize Plant at Different Periods of Growth.

DULEY F. L. and MILLER, M. F. (1921). *Missouri Agr. Res. Bul.* 42.

Maize plants were grown in sand cultures with PEFFERS's nutrient solution of normal and N/20 concentrations. The growth period was div-

ided into three thirty day periods and all possible combinations of the two concentrations of solution were used. The second 30 day period was by far the most important for the production of dry weight. The top growth was always increased by an optimum supply of nutrients while a low supply of nutrients was conducive to increased root weight and to fibrous root development particulary during the last period. The ratio between the weight of roots and tops became wider as the crops grew older or as the concentration of the nutrient solution was increased. With low nutrient at the end of the first 30 day period the roots made up 61.18 per cent. of the total weight of the plant, but with plants having a high concentration of solution and 90 days old the roots made up only 12.29 per cent. of the total weight of the plant.

Where there was a copious supply of mineral elements present at the end of the second period, the leaves and stalks contained enough material to produce fair ears even where the third period had minimum nutrient. The per cent. of nitrogen and potassium in the plants was approximately proportional to the supply of nutrients during the period just previous to harvest.

In all treatments and in each period, a minimum supply of nutrients allowed a greater proportional storage of nitrogen, phosphorus, and potassium in the roots than did optimum treatment. A minimum nutrient supply changed somewhat the character of growth, particularly by reducing the length of the internodes. This was most marked where the plants had received optimum treatment during the first period.

Comparative Value of Alfalfa and Sweet Clover on Soils.

HOLTZ, H. F. and SINGLETON, H. P. *Journal of American Society of Agronomy*, Vol. XVII. No. 6, pp. 326-333. Geneva, N. Y. 1925.

The arid soils of the State of Washington contain sufficient mineral plant food elements, but are deficient in organic matter and nitrogen. When these soils are brought under irrigation alfalfa is generally grown to supply the nitrogen deficiency.

Soil samples were taken from fields which had grown alalfa and sweet clover respectively for three years in succession, and other samples were taken from land that had grown these plants for three years followed by one year of maize. In addition, two other soils were selected, one virgin land never irrigated, the other an irrigated soil but which had never grown a leguminous crop.

In the experiment a comparative study was made of the carbon dioxide evolution and nitrate nitrogen accumulation.

Soil from sweet clover land had 102 % greater carbon dioxide evolution and 95 % greater nitrate nitrogen accumulation than soil from alfalfa land.

The yield of maize silage per acre was 14.92 tons on sweet clover land and 8.25 tons on alfalfa land.

Both virgin arid soil and the same soil after irrigation and cropping with non-legumes for two years, showed low carbon dioxide evolution

and nitrate nitrogen accumulation, owing to their low content in organic matter.

There is a greater carbon dioxide evolution during the first ten days and a greater final nitrate nitrogen accumulation from sweet clover than from alfalfa, whether they are grown in the field or applied as a residue.

For purposes of supplying available soil nitrogen to new land for establishing a short rotation, for seeding a pasture, or an orchard cover crop, sweet clover is especially suitable, because of its high nitrogen content and rapid decomposition when returned to the soil. W. S. G.

Regional Soil Science.

The Geology of Istria.

CUMIN, G. Appunti geologici sull'Istria montana. *Proceedings of the R. Accademia nazionale dei Lincei,* Vol. XXXIII, No. 5 pp. 174-177. Rome, 1924.

Orographically it is possible to distinguish three mountain systems in Istria, viz. in the West the undulating high table lands, in the centre an area characterized by mountain ridges, in the East the chalky plateau of the Valsecca of the Castelnovano. The prevailing soils are for the most part calcareous, and there is a relatively small amount only of sandy soils, marls and schist clays.

The earliest formations are represented by the Cretaceous, always of the calcareous type. The oldest layer is Cenomanian sometimes combi-ed with Turonian, which in this area is represented by grey calcareous breccia with a marl or dolomitic cementing, showing no fossils. This is covered by a blackish grey dolomitic mass. The dark Turonian chalks are in ridges varying from 0.80 to 1.50 metres in depth, over which lie strata of varying geological formation corresponding to the rubble rocks of Nabresina. There is no Cretaceous formation such as is typical of the Triestine Carso.

The base of the tertiary formation is represented by Liburnian, which in the lower strata is a lagoon, and in the upper a marine, sediment, consisting of black carbonaceous and dark-grey calcareous material. This merges without any definite dividing line into Lutetian, formed by light grey, white or more rarely blackish chalk, containing a numerous but not particularly varied fauna making it possible to distinguish different layers, which however do not exhibit any marked geological differences.

Above the calcareous system lies an intermediate formation, partly breccia, partly marl, over which lies the sandy marl layer of Bartonian Liburnian, a highly composite formation, consisting mainly of sandy marl and sandy flint schists with a calcareous cementing, and clay schists in variously alternating and shallow layers. Among these clastic rocks are found chalk ridges, particularly developed in Southern Istria.

The red soil belongs to the early quaternary period and partly to earlier periods ; it lines the bottom of the Carsic and Doline pockets but is never found over extended surfaces. A. F.

Goethe and the Sicilian Red Earth.

FISCHER, Herm. (Munich). Goethe und die sizilianische Roterde. *Revue Internationale de Pédologie*, Nos. 3-6 1924.

In Lower Italy and Sicily red earth is not the prevailing type of soil; on the contrary, as a typically climatic soil it occurs only in an isolated manner and is only to be found to any extent near Palermo. Even there its occurrence is limited to the chalk and dolomite mountains. Red earth occurs as a secondary stratified deposit, i. e. in the plains. It is only formed above very fine, crystalline carbonate rocks. A higher proportion of clay in the rock seems to prevent its formation. The red colouring iron compound may be due to the original content of the non-decomposed rocks in iron sulphide and iron carbonate. The approximate extent of red earth round Palermo has been illustrated by a sketch map, in the article. It follows that, owing to the nature of the rocks (Noric dolomite) and the climatic conditions (high summer temperatures with sufficient precipitation) the coastal district of Cefalu near Trapani is favourable to the formation of red earth. In the interior of the country red earth is seldom to be found, and it is confined to the southern side of the mountains.

As early as 1787 GOETHE, on his journey to Sicily, followed the line of occurrence of red earth near Palermo. Red earth in primary stratification is found: (1) at Mount Pellegrino, (2) at San Martino, and (3) behind Monreale. The zone of outcrop of dolomite was also observed by GOETHE. Starting from beneath Monreale, the author has submitted to chemical analysis the non-decomposed dolomite, the zone of white, friable, deposit and the red earth lying above it, and has found that, in decomposing, dolomite loses a greater percentage of magnesium than lime. The sesquioxides increase fifty-five times more in red earth, as compared with their proportion in dolomite. On the heights of the mountains surrounding Palermo red earth is not formed, but a deposit occurs, which is poor in humus, and externally somewhat resembles brown earth. The AUTHOR.

The Soils of Moistad Experiment Station, Hedmark, Norway.

GLOMME H. Meldinger fra Norges Landbrukshøiskole, No. 1, 1924, pp. 33-92, bibliography, 1 map. Oslo, 1925.

The article gives a detailed description of the soils occurring at Moistad Experiment Station, Hedmark; similar investigations are to be made at the Norwegian Station.

The investigations have been carried out by means of borings made to a depth of 1 metre, the character of the soil being examined at different horizons. Samples are submitted to mechanical analysis, determination of water capacity, volume weight, specific gravity, pore space, chemical analysis and determination of H-ion concentration and buffer effect.

The bed rock is formed of Ordovician limestone and slates, and the soils consist, from a geological point of view, of moraine residues and peat and similar organic soils. W. S. G.

Soils of Pays de Gex.

GRAVIGNE, GILLET and DENIZET. Étude scientifique des terrains, des fourrages et des laits du Pays de Gex. *Congress on Alpine Pasture at Gex*, pp. 35. Dijon, 1924.

Pays de Gex consists of an arrondissement of the Department of Ain on the Swiss frontier. It is a mountain range stretching from South-East to North-West over an extent of forty kilometres and rising to from 1300 to 1600 metres in height.

It is formed of the Middle Jurassic strata, viz., Astartian, Sauracian, and upper (Portland) limestone, flanked by Lower Cretaceous rocks (Urgonian) or marls (Valangian).

On the West lies the valley of the Valserine, a tributary of the Rhone. On the East is the plain of Geneva, which is relatively a plain, and of glacial formation with alpine erratics and Molasse outcrops rising to a height above 600 metres.

Going from East to West however, it has been possible to distinguish the following bands or zones: Alpine erratics zone with variable lime content. Soil called "battante", having fine sandy constituents piled up under the action of rain, and without any nitrogenous matter.

Glacial Zone with outcrops of Molasse, clayey, content variable as to limestone, scarcely "battante."

Intermediary Zone between the plain and the mountain, the same strata dominated by the Lower Cretaceous at the foot of which the towns are built.

On the slopes, the soils are tenacious and argilo-calcareous. In the South they are less clayey and not calcareous. Zone of the Valserine clay soils rich in nitrogen and phosphoric acid, prevail.

On the plateaus are friable soils.

If the proportion of grasses G., leguminous plants L. and sundry plants D., be reduced to 10, the following result is obtained for the plain *meadows* (height 500 to 700 m.).

$$5 \text{ to } 6.5 \text{ G} + 1 \text{ to } 3 \text{ L} + 2 \text{ to } 3 \text{ D}.$$

On the unwatered slopes, from about 700 to 900 m., are found: 1 or 2 G + 3 L + 5 or 6 D; in other words, the proportion of grasses decreases.

On alpine pastures at a height between 130-150 metres there is a still greater increase in the proportion of diverse plants of which a large number are decorative (Orchids) or medicinal (Gentian, Thyme, Veronica).

The richest milks come from the most fertile zone at the foot of the mountains (Lower Cretaceous), where the fat content is 41 grams instead of the average 39 in the plain and 38 ½ in the Valserine.

PIERRE LARUE,
Gurgy sur Yonne.

Beetroot Soils in Bohemia.

JANOTA. R. Sur les sols betteraviers en Bohême. *Publication of the Ministry of Agriculture*, pp. 79. Prague, 1923.

The cultivation of beetroot in Bohemia is carried on mainly in a district where the soil is more favourable than the climate to its growth. The amount of rainfall is a limiting factor for the development of this crop, and hence there is an intimate connection between rainfall and yield.

Beetroot soils are : calcareous and non-calcareous loess, alluvial and Permian clays and lastly the sandy clay of the carboniferous stratum. The physical properties, and above all, the air and water capacity of these soils make them well suited to beetroot. The author has studied the variations of the physical condition of the soil profile under all its aspects, and draws the conclusion that beetroot requires deep tillage to ensure a sufficient quantity of water. Czech beetroot soils have the following content in nutritive matter (in 10 % HCl).

P_2O_5	0.1 %
CaO	0.5 to 1.5 %
K_2O	0.25 to 0.3 %
N (total)	0.15 to 0.3 %
Humus	0. to 4.0 %

SMOLÌK.

Soils of Overflow Meadows on the Banks of the Volxhov and Lake Ilmen.

PRASSOLOV, L. Untersuchungen des Flusses Wolchow und dessen Bassins, Bul. IV, pp. 5-24, with 7 maps. Leningrad, 1925.

The overflows of the Volxhov and Lake Ilmen have a total extent of over 1500 square km. The chief meadow areas are the deltas of the Lovat and the Usta on Lake Ilmen as well as the great flood plain of the Volxhov at the Grusino. In the flood plain of Lake Ilmen alluvial sub-clayey and sub-sandy stratified soils prevail. However, the greater part is occupied either by swampy meadows of low level, or by peat bogs. High overflows also include large forest areas. In the valley of the Volxhov, clayey, alluvial soils are found, sometimes covering the whole area. In the riverside part of the plain unstratified, alluvial meadowy soils of granular texture. Their area is however not large. The low level areas are most general, either with clayey swampy soils, or peat-bogs. In the region of Grusino, elevations of two kinds are encountered ; some of them are no more than 1-2 m. in height and are narrow and elongated, the so-called " weretye " (roller) with clayey alluvial, but clearly podzol soils. Others are higher, not overflowed by high water (25-35 m. above sea level), consisting of glacial deposits. Sandy undulations and hillocks may also be seen either along the tributaries of the Volxhov, or on the banks of ancient lakes. A considerable part of the flood plain of the Volxhov, mainly

on its left side, is covered with forest. Soils here are swampy podzol. Similar soils are encountered under a stratum of new alluvium and in the meadow part of the valley, together with "buried" peat-bogs.

To estimate the effect upon the soils of the valley of the Volxhov, produced by the rise of its waters due to the dam under construction, continuous observations were undertaken in 1924 on the level of the soil water and the humidity of the soil (together with observations on vegetation).

The soil of the flood plain of the Volxhov and the lake Ilmen are in their present natural state of different value grading from best soils of highest value (such as riverside granular soils) to those of low value and useless marshes. In respect of area, the soils of middle and low quality prevail, many of them however, might be improved and have perhaps, a great "potential" value. AUTHOR.

Geology of the Sarthe.

WELSCH, JULES. Esquisse géologique des régions naturelles du Department de la Sarthe, pp. 30. I map in colour, scale I/320.000. Le Mans, 1924.

The primary stratum forming the Western part of the Armorican massif is frequently vertically inclined and is crossed by Granites, Porphyries, Amphilolites, Diorites, Diabases and Petrosilex which only play a secondary part in agriculture.

The schists give a deep siliceous soil often covered with heath. The Silurian magnesian limestone is valuable.

Sandstone intercalations (Armorican sandstone) occur in the middle of the schists, covered with heaths and pine forests.

The Devonian and the Carboniferous layer yield lime for agriculture. The kilns from which lime was exported to Brittany are still to be seen along the face of these strata.

Secondary strata are represented by Jurassic and Cretaceous formations.

Jurassic. — Marl Lias only appears to a certain extent in the North.

Middle Jurassic (Bajocian, Bathonian, Collovian, Oxfordian) form the *Champagne du Maine.*

The term "Champagne" or "Campagne" is used in France to designate the calcareous treeless plains belonging to Middle or Upper Jurassic and to Upper Chalk.

In the Sarthe and the West of France, the arable land, which is pebbly and from which the lime is washed only to a shallow depth, is called "groie". It is red and argillo-calcareous. These are districts with dry, cereal-producing valleys. Certain strata of Bathonian contain flints.

The more marly Oxfordian is the formation of Saosnois and Belinois which are surrounded by heaths and pines of the Forest of Perseigne on one hand, by ferruginous Cenomanian sands on the other, and by the valley of the Huisme which meets the Sarthe at Le Mans. These tenacious marly soils are well suited for artificial meadows and cereals.

The Cretaceous rocks begin by Cenomanian, which took its name from

Le Mans (Cenomanum) and is generally silico-ferruginous with glauconite: Perche sands with reddish coloured sandstone: soils suitable for rye and potatoes occur in woods of Scotch or Baltic pine.

Marly chalk beginning in the Cenomanian layer continues in the Turonian and the Senonian in the South-east of the Department. It forms the sides of the valleys which are lined with clay containing flints washed out of the chalk: it is also the tufa of Anjou, sometimes containing flint nodules or shale and provided the marl for applying to the soils of the siliceous plateaus. Content in calcium carbonate: 50 to 95 %.

Cretaceous layers cover 200 000 hectares of varied aspect out of the 624 000 hectares of the Department of the Sarthe. Clay with flints covers 80,000 hectars.

Clay can be brought up again to the surface, which makes it more easily worked and there is a scarcely perceptible transition to the clay of the somewhat calcareous argilo-sandy plateaus of Pliocene origin.

Ancient alluviums cover from 50 000 to 60 000 hectares. They are generally siliceous, with the exception of those of the Saosnois Orne which cross the Jurassic calcareous strata. They are for the most part dry and bear pine and oak.

Recent alluviums (50 000 hectares) are richer and moister: meadows, vegetables, poplar trees.

PIERRE LARUE,
Gurgy sur Yonne.

The Agricultural Regions of North Dakota.

WILLARD, Rex E. *Bulletin* 183 *North Dakota Agricultural Experiment Station*, pp. 168, figs. 64, tables 20. 1924.

The Bulletin gives the location and description of the Black Earth Belt (Eastern), the Farming Grazing Belt (Central) and the Grazing Forage Crop Belt (Western), the climate, soils, land utilization, and general trend of both yield and acreage per farm. The area, size of farm, climate, soils, crop areas, crop yields, crop damage, extent of live stock per farm, position as regards production of the State and the agricultural districts of each county are stated. Yields of wheat, oats, barley, rye, flax, corn, potatoes, and hay are given for 1911 to 1922, inclusive.

T. CHAPMAN,

The Principal Results and Fundamental Problems of Soil Investigation in Georgia.

ZACHAROV, S. A. *Annals of the State Polytechnic Institute, Tiflis,* Vol. 1, pp. 1-56. 1924.

The soils of Georgia (formerly Tiflis and Kutais departements) have not as yet been subject to systematic investigations. Short descriptions exist and sketch maps of the low part of Western Georgia and Adahzaristan only, but investigations of Eastern Georgia, and mountain district are scarce and occasional. This short essay is to be considered as an attempt

to make use of scattered information about the soils of Georgia to summarise them and give a temporary classification of the soils, divide the country into areas, and point out the essential theoretical and practical problems that the soil investigations in this country have to resolve.

The soil of Georgia varies greatly in accordance with the combinations of the soil forming agencies, among which the relief is of prevailing importance: it influences the soil directly, and also indirectly, and is reflected in climate and vegetation.

The predominant types of soil formations in Georgia are:

1. Laterite soils;

2. Podzol soils (white ash-coloured and very much leached);

3. Forest soils;

4. Maroon brown soils (soils of herbaceous steppes, maroon brown colour);

5. Brown soils (soils of worm wood — herbaceous steppes);

6. Mountain meadow soils (alpine meadows — "Eylags").

Besides the completely developed, or normal soils, incompletely developed soils are largely found in Georgia. Their formation has been disturbed by geological processes: denudation, "diluvium" and "proluvium", resulting in the formation of rough, skeleton (stony) soils, in which the local soil-forming process is not fully expressed.

According to distribution of soils Georgia may be divided into areas as follows:

I. Soil area of Western Georgia (Kolchida).

1. Marsh-podzol zone of Kolchida lowland, below 1000 feet, with rainf all of 1200-1700 mm. Alder forest with lianas.

2. Laterite-podzol zone of lower mountains of Kolchida, 50-3000 feet elevation, with rainfall of 2400-1200 mm. Forest with lianas.

3. Zone of forest soils of Western Georgia-middle, mountains 2000-6000 feet elevation, with rainfall about 1200 mm. Oak, beech and fir forests.

II. Soil region of Eastern Georgia (Kartli and Kakheti).

4. The zone of tchernozem and maroon coloured soils occupies the lowest and dryest parts of valleys, lower mountains and plateaux below 3000 feet, with rainfall, about 600 mm.; covered with halophytes — worm wood — herbaceous and mixed herbaceous steppes.

5. The zone of forest soils occupies a part of the valleys and central mountains of 2000 to 7000 feet elevations, rainfall 500-800 mm. Elm, oak, beech, pine and mixed forests.

III. The mountain zone — tchernozem occupies the plateau of Little Caucasus, 5000-7000 feet; with rainfall of 500-600 mm.; meadowy mountain steppes with Stipa.

7. Zone of mountain soils of the ridges and summits of the Little Caucasus with Festuca-steppes.

IV. The high Mountain soils, region of Georgia occupie the areas above 6000-7000 feet to the snow-line. It is characterized by a local climate and local soils. It can be divided in following districts:

8. Zone of high mountain soils of the Great Caucasus, with rain-

fall of 1200 mm., with alpine and richest sub-alpine tall herbaceous meadows (swaneti).

9. Zone of high mountain soils of the Adzhjaro-Jmereti and Trialety chain with rainfall of more than 800 mm. and with alpine and sub-alpine meadows.

Among the theoretical problems, which are to be resolved next, we mention the following:

(*a*) The vertical distribution of soils;

(*b*) The origin of laterites and of their residual character;

(*c*) The origin and the conditions of brown forest soils, original soils of Georgia;

(*d*) The geography and topography of mountain meadow soils;

(*e*) The history of the soil mantle on Georgia in connection with the presence of degraded, buried and fossil soils.

Practical problems of study of soils are the following:

(*aa*) The study of carboniferous soils of vineyards and the nature of carbonates, in order to extend the use of American *Phylloxera* resistant stocks;

(*bb*) Manuring and tillage of laterite soils;

(*cc*) Manuring and tillage of podzol soils;

(*dd*) The study of mountain meadow soils in order to use them in the most scientific way;

(*ee*) A detailed division of the country into soil regions;

(*ff*) Soil testing.

The new Faculty of Agriculture, represented by professors and students — future agriculturists — is willing to do its utmost with respect to the study of soils in Georgia.

AUTHOR.

Bibliography.

General.

HISSINK, D. J. Introductory Paper, *The Faraday Society*, December 1924.

Revista Muzeului Geologic-Mineralogic al Univesitatii din Cluj, Cluj, 1925. Institutul de Arte Grafice « Ardealul » Str. Memorandului 22.

Soil Pysics.

FISCHER, Karl, Die Verdunstung des Weserquellgebietes, in methodischer Hinsicht betrachtet. *Meteorologische Zeitschrift*. Part, 7, 1924.

FISCHER, KARL. Der Sinn der Gleichung: Niederschlag: Abfluss, Verdunstung, Versickerung. *Meteorologische Zeitschrift*. Part. 8, 1924.

HISSINK, D. J., VAN DER SPEK, Jac. Studie von en Proefnemingen op Slempige Gronden door het Rijkslandbouwproefstation, Groningen. February 1925.

KLANDER, F. Ueber die im Buntsandstein wandernden Verwitterungslösungen in ihrer Abhängigkeit von äusseren Einflüssen. *Chemie der Erde*, Vol. 2, pp. 49-82, 6 diagrams. Jena 1925.

NOSTIZ A. v. Neue Gesichtspunkte und Hilfsmittel zur Uebertragung physikalischer Bodenuntersuchungsergebnisse in die Praxis. *Landwirtschaftliches Jahrbuch für Bayern.* Nos. 7-8. 1925.

REINAU, E. H. und KERTSCHER, F. Die Umwandlung der Sonnenenergie des Wassers und des Kohlenstoffes in der Landwirtschaft. *Aus der Versuchs- u. Lehranstalt für Bodenfräskultur der Siemens-Schukkertwerke G. m. b. H. zu Gieshof*, Publisher, Julius Springer. Berlin, 1925.

Soil Chemistry.

BLANCK, E. und RIESER, A. Ueber die chemische Veränderung des Granits unter Moorbedeckung. Ein Beitrag zur Entstehung des Kaolins. *Chemie der Erde*, Vol. 2. Part. 1. Jena 1920.

DOBRESCU-CLUY, J. M. Die Dynamik der Kaliassimilation kalihaltiger Silikat-Minerale. *Chemie der Erde*, Vol. II, pp. 83-102, 1925.

COMBER, N. M. The Role of the Electronegative Ions in the Reactions between Soils and Electrolytes. *The Faraday Society.* December 1924.

FISHER, E. A. Base Exchange in Relation to the Swelling of Soil Colloids. *The Faraday Society*, December 1924.

FISHER, E. A. Base Exchange in relation to Adsorption. *The Faraday Society*, Secember 1924.

GORSKI and W. JANKOWSKA, Analysis de deux profiles des loess de pays-bas de Bug. Czcionkami Drukarni Uniwersytetu Poznanskiego. *Institut de chimie agricole à Dublany.* Poznan 1923.

HEADDEN, W. P. The Effect of Nitrates on the Composition of the Potato. *The Colorado Experiment Station, Bulletin* No. 291, Fort Collins, 1924.

HEADDEN, W. P. Some Orchard Conditions affected by Arsenicals, Marls and other Factors. *The Colorado Experiment Station, Bulletin* No. 294, Fort Collins 1924.

HISSINK, D. J. Das Wesen, die Bedeutung und die Bestimmungsmethoden der Bodenazidität. *Zeitschrift für Pflanzenernährung und Düngung*, Section A, Year IV, Part. 4.

HISSINK, D. J. De verzadigingstoestand van den grond. A. Minerale gronden (Kleigronden). *Rijkslandbouwproefstation, Groningen*, 20. Nov. 1924.

HISSINK, D. J. Der Sättingungszustand der Böden. A. Mineralböden, *Zeitschrift für Pflanzenernährung und Düngung* IV. Section A, Year IV, Part 3.

HISSINK, D. J. Base Exchange in Soils. *Transactions of the Faraday Society*, Vol. XX, No. 60. Section 3, 1925.

PACE H. J. und WILLIAMS, W. Studies on Base Exchange in Rothamsted Soils, *Transactions of the Faraday Society*, Vol. XX, No. 60, Section 3, 1925.

PAGE, H. J., M. B. E., B. Sc., A. I. C. Soils and Fertilisers. *Society of Chemical Industry. Reports of the Progress of applied Chemistry*, Vol. IX. 1924

PAGE, H. J., M. B. E., B. Sc. The Chemistry of Soils and of the living plant. *Annual Reports of the Chemical Society*, Vol. 21, 1924.

PAGE, H. J. und WILLIAMS, W. Studies on Base Exchange in Rothamsted Soils, *The Faraday Society*, Dec. 1924.

RAMANN, E. Die chemisch-physikalischen Wirkungen von Aetzkalk und kohlensaurem Kalk in Mineralbödrn. *Zeitschrift für Pflanzenernährung und Düngung*, Year III, Section A. Part 4.

ROBINSON, G. W. und WILLIAMS, Rice. Base Exchange in Relation to the Problems of Soil Acidity. *The Faraday Society*, December 1924.

SAINT, S. J. The Relation between the P_H value, the Lime Requirement, and the Thiocyanate Colour of Soils. *The Faraday Society*, December 1924.

Soil and Vegetation.

WIESSMANN, H. Hat Kieselsäure bei unzureichender Phophorsäureernährung einen Einfluss auf den morphologischen und anatomischen Bau des Roggenhalmes? *Zeitschrift für Pflanzenernährung und Düngung*. Year IV. Section IV. Parts 1-2.

Classification.

VILENSKY, D. The Analogical Series in Soil-Formation and a new Genetic Classification of Soils. With a coloured diagram showing 20 of the most important soil types. Kharkow 1925.

Regional Soil Science.

BRUNNER, J. Die geologischen Verhältnisse Unterfrankens und ihr Einfluss auf die dortige Landwirtschaft. *Mitteilungen der D. L. G.* Meeting of Sept. 1924, pp. 684-686.

GOLONKA, Z. Czcionkami Drukarni Uniwersytetu Poznanskiego. Die Böden der Waldreviere Bobrek bei Oswiecim, Wojewod-schaft Krakau. (Russian). Poznan 1924.

HEADDEN, W. P. A peculiar soil condition in the San Luis Valley. *Bulletin of the Colorado Experiment Station* No.286. Fort Collins, 1923.

NOMMIK, A. Ueber den Boden Estlands. *Veröffentlichungen des Kabinettes für Bodenkude und Agrikulturchemie der Universität Tartu* (Dorpat) Esthonia, No. 2, 1925.

Communications.

International Society of Soil Science. — The number of members is now 592, of whom only about 400 have paid their subscriptions and entrance fees for 1925. This made it necessary to send out a reminder to nearly 200 members, involving considerable time and expense.

I should like to take this opportunity of once more pressing on my colleagues the desirability of forming national sections, which could take over a part of my work, for example: the sending of notices, etc. to new members, the collection of subscriptions, recording of change of address, etc. A proportion of the annual subscription of 6.50 francs, either 0.50 or 0.75 fr. could be placed at the disposal of the national sections for the purpose of covering expenditure.

As you will be aware, on Circular 4 of May 1925 I requested the members to inform me whether they wished to receive the Proceedings of the International Soil Science Conference in Rome (May 1924) at the reduced price of 80 francs, the price for the general public being 150 francs. A number of members have misunderstood the circular and have sent me the 80 francs. I have therefore to ask them to note that the matter is in the hands of the International Institute of Agriculture (Villa Umberto I. Rome [10], Italy) and that I have forwarded all money sent to this address. Members who have made enquiries as to the date of publication of these proceedings are also referred to this address.

Members are again requested to remit the annual subscription in Dutch guilders, either by post office money order or to the Geldersche Crediet Vereeniging, Groningen (Holland), paid to the account of the International Society of Soil Science. In either case it is essential to add my name.

By arrangement with the editor, Prof. SCHUCHT, the list of members will appear in the first part of the new year 1926. Members are therefore requested to be so good as to send me word of any change of address in good time.

Dr. D. J. HISSINK,
Acting President and General Secretary.
Herman Colleniusstraat 25, *Groningen* (*Holland*).

Brief statement concerning progress made in the organisation of the First International Congress on Soil Science. — (1) The personnel of the Organising Committee has been completed. It consists of: F. J. ALWAY (University of Minnesota, St. Paul), F. E. BEAR (Ohio State University, Columbus), G. S. FRAPS (Agricultural and Mechanical College, College Station, Texas), R. HARCOURT (Ontario Agricultural College, Guelph, Ontario), S. B. HASKELL (Massachusetts Agricultural College, Amherst), D. R. HOAGLAND, (University of California, Berkeley), T. L. LYON (Cornell University, Ithaca, New York), C. F. MARBUT U. S. Department of Agriculture, Washington, D. C.), A. G. MCCALL (University of Maryland, College Park), W. H. MCINTIRE (University of Tennessee, Knoxville), M. F. MILLER (University of Missouri Columbia), F. T. SHUTT (Dominion Experimental Farm,

Ottawa, Canada), F. A. WYATT (College of Agriculture, Edmonton, Alberta), J. G. LIPMAN (Director, Experiment Station, New Brunswick, N. J.).

The personnel of the Exhibits Committee has also been completed. It consists of: E. TRUOG, (Chairman, University of Wisconsin, Madison), C. H. SPURWAY (Michigan Agricultural College, East Lansing), S. D. CONNER (Experiment Station, Lafayette, Indiana), R. M. SALTER (Ohio State University, Columbus), H. J. HARPER (Iowa State College, Ames), F. W. PARKER (Experiment Station, Auburn, Alabama), W. W. WEIR, (U. S. Department of Agriculture, Washington, D. C.).

(2) The Secretary of Agriculture, Mr. JARDINE, has promised to see that a resolution is introduced after Congress convenes in December. This resolution will authorize the President to invite foreign governments to send delegates to the Congress.

(3) The itinerary of the field excursion, which is to follow the meetings in Washington, has been prepared by Dr. MARBUT. Arrangements will be made to dig pits at certain locations in the United States, and possibly also in Canada, in order that the soil profiles may be clearly shown to members of the Congress.

(4) Funds are being collected for financing the field excursion. It is hoped that enough money will be available so that the field excursion, which will last about four to five weeks and which will carry the party from the Atlantic to the Pacific shore, will be without cost to the foreign delegates. Very substantial contributions toward the expense of the field excursion have already been promised.

(5) It is expected that by next November, when a formal meeting of the Organizing Committee will be held in Chicago the necessary funds for financing the field excursion will have been subscribed. At that time final arrangements will be planned for the program and for the appointment of such other committees as will be necessary to insure the success of the meetings in Washington, etc.

(6) The National Research Council. The Association of Land Grant Colleges and the American Society of Agronomy have also pledged their co-operation. The American Association for the Advancement of Science and the National Fertilizer Association will also offer such co-operation as they may be able to give us.

(7) Additions to the membership of the International Society of Soil Science are constantly being made. It is expected that by next fall there may be possibly as many as two hundred members in the United States.

J. G. LIPMAN.

Etat de l'étude et de la cartographie du sol dans les divers pays. — This volume, published under the direction of the late Professor MURGOCI is now printed in full, with the exception of three colour maps which cannot appear therefore this winter. Since the last International Soil Science Conference, Professor MURGOCI added many photographic illustrations and plates to this volume.

Those who, previous to the last International Conference, received the incomplete volume, may apply for the work in its final form to Prof. PROTO-

PESCU-PAKE, Institutui Geologic al Romaniei, Sectinea Agrogeologica, Soseana Ardealului (Kiselef) No. 2. Bucharest, Rumania.

Appeal for Cooperation in the Work of the Sixth Commission on the Application of Soil Science to Scientific Agriculture. — The utilization of the soil of the national territory so as to cover most completely the subsistence requirements of a country, proved during th. war in every country to be one of the most important tasks of the public economy. In consequence, close attention was given during the war by all circles and even more has been since given to the improvement of the soil with a view to intensification of the production of necessaries. There has been accordingly a development beyond all anticipation in the technique of cultivation, directed towards such treatment of the soil as will ensure a better agricultural utilisation. In close connection with this the need is felt for depending this branch of technique on scientific lines, which would also have the effect of rendering the relations between the soil and the means for its improvement, the subject of practicable scientific research.

The Third International Soil Science Conference, held in Prague in 1922, recognised the interrelation between these facts and took them into account so far as to appoint a sub-committee of the Commission for the Study of Soil Physics and Mechanics, which should make a special study of the application of soil science to scientific agriculture. This sub-committee took upon itself for the Fourth International Conference in Rome in the year 1924 a task of some magnitude, which consisted in the application to scientific agricultural schemes of mechanical analysis of soils by decantation.

The Commission drew up a number of conclusions on the basis of proposals and discussions, and among these the following may be specially mentioned:

A. The Organisation of Soil Science Service.

(1) A complete and scientifically sound knowledge of soils is the essential basis for an effective and economical solution of all amelioration problems. Hence all measures for soil and land improvement should be based on absolutely reliable soil and hydrological investigations.

(2) It is essential that provision be made for the organization of facilities for soil investigations in their relation to land cultivation. It is recommended to the respective governments that, where this has not already been done, suitable committees be appointed to serve in an advisory capacity as regards the organization of a soil science service. An effective organization of this sort has been created in Czechoslovakia.

(3) Research on land reclamation and water supply problems is urgently needed for the development of land cultivation methods.

(4) It is necessary that the college curriculum in agricultural engineering should be based on the natural sciences with special reference to soil slence.

(5) In order to avail ourselves promptly of the definite results from the accumulated comparative experiments in the various countries under the most variable conditions, it is important that all societies, institutions, bu-

reaus and other bodies interested in soil science, should become affiliated with the "Committee on the application of soil science to scientific agriculture" of the "International Society of Soil Science."

(6) This International Committee met for the first time in Rome in May 1924. The working programme accepted for the soil science service in Czechoslovakia and also the plans proposed for Germany were submitted. These projects may be considered as the basis for a programme of soil science service in each country.

B. The Programme for the future work of the Committee.

(7) As topics for consideration at the next conference the following should be studied:

(*a*) Working methods of the Soil Science Service.

(*b*) Organization of experiments on methods of soil improvement.

(*c*) Data on the influence of the improvement of various soil types.

(*d*) Results of the experiments in land cultivation in reference to the "drainage theory" (depth and distance). In order to obtain comparative results it is desirable that the Committee members should receive from the various countries descriptions of the established drainage experiments of characteristic soil profiles.

The next meeting of the Commission, which will take place in Washington on the occasion of the First International Soil Science Congress in 1927, will be devoted to these and other important questions of soil science and scientific agriculture and will attempt their solution on an international basis.

It is obvious that there will be a fuller realisation of the end in view in proportion as experts both on the scientific and the practical side become members of the Commission and in proportion as more countries are represented on it. The more varied the scope of the work of the Commission, the greater value will attach to the results of its investigations.

The Commission therefore makes an appeal to all experts, who are engaged in scientific agriculture either on the purely scientific or on the practical side to join the Commission and to take an active part in its work, and the State authorities who administer the service of scientific agriculture, are invited to appoint representatives on the Commission.

It is our firm conviction that our work will be of great value to all countries and we are of opinion that for this reason we may count on some consideration of this invitation to join the International Society of Soil Science and in particular to join this Commission.

Groningen and Zurich, 25 September 1925.

For the International Society of Soil Science: The Acting President and General Secretary,
Dr. D. J. Hissink,
Herman Colleniusstraat 25, Groningen.

For the Sixth Commission for the Application of Soil Science to Agricultural Science:
Chairman of the Commission,
J. Girsberger, *Ing. Agr.*
Zurich.

The conditions for admission to the International Society of Soil Science are as follows :— Any individual or body corporate engaged in the study of soil science, is eligible for ordinary membership.

Members of the Society are entitled to receive the Review post free on payment of the annual subscription.

The subscription for 1925 is 6.50 Dutch guilders, with an entrance fee for new members of 2.50 guilders.

Proposals for membership must be sent to the Acting President and General Secretary of the International Society of Soil Science, Dr. D. J. HISSINK, Herman Colleniusstraat 25, Groningen (Holland), or to the Chairmrn of the Sixth Commission for the Application of Soil Science to Scientific Agriculture, J. GIRSBERGER, Ing. Agr., Zurich, Switzerland.

Proceedings for 1926. — We kindly ask the readers of our paper to be patient with us if the various issues do not appear as punctually as is desirable There are many technical difficulties to overcome, but these seem to be eliminated now after a conference of the undersigned editor with Dr. G. A. R. BORGHESANI, which took place in August 1925 in Rome. For technical reasons the size of the present number 4 had to be cut down somewhat, but from January 1926 on the paper will again be edited with increased contents and, above all, will appear punctually.

F. SCHUCHT,
Editor.

PROCEEDINGS OF THE INTERNATIONAL SEED TESTING ASSOCIATION

Papers.

CONTRIBUTION TO A MONOGRAPH ON THE DETERMINATION OF THE COUNTRY OF ORIGIN OF CLOVER AND FORAGE CROP SEED.

When it was realised, that, according to their country of origin, seeds may be grown in quite different conditions, the determination of the country of origin became one of the most important tasks of seed laboratories. It is known that incidental seeds are removed from the samples to be examined and on the basis of their geographical extent, the country of origin of the seeds is determined. Many works have already been published on the subject, but they often follow no definite method and are sometimes incomplete and do not give a full tabulation of incidental seeds in samples from different countries.

Consequently, in the third International Conference on Seed Testing, Dr. A. VOLKART pointed out, in a report on determining the country of origin, the necessity of taking notice not only of the weed seeds removed for the above mentioned purpose and which so far served as guides, but also of every other incidental seed occurring in a sample, as well as of other signs. Dr. VOLKART was then charged by the Congress to make proposals for a method of research for determining the country of origin of clover and forage crop seed, a standard method capable of answering every requirement. The proposals were forwarded to the representatives of the various countries taking part in the Congress. In consequence of this, the directors of the State seed laboratories of each country must examine, according to definite instructions, a quantity of seed samples of their own country, with a view to the detection of foreign seeds, to weight per thousand seeds and to colour, determining at the same time, the incidental seeds according to species and number. In the fourth International Conference for Seed Testing held at Cambridge in 1924, Dr. VOLKART was already enabled to describe many researches conducted after the method he suggested and which had brought to

light valuable and so far unknown facts. Unfortunately Dr. VOLKART is no longer able to continue directing the work. Therefore, in the fourth Conference, at Cambridge a Commission was appointed, with the help of which the task is to be continued by myself. Having agreed with the Director Dr. VOLKART, on the beginning of March, and having taken the advice of the members of the Commission, the most convenient arrangement seems to follow the excellent plan proposed by Dr. VOLKART, making works known under the above mentioned title.

In the compilation of the results obtained a distinction was made on the one side according to the frequency of occurrence of the additional seeds in all the samples (constancy), on the other side according to the number in each sample (dominance). The following summary of each test of the country of origin show the frequency of occurrence (constancy) by reporting the number of the samples in which each species is found, shown in four sub-divisions :

Very frequent additional kinds	in 75.1-100 %	of the samples tested
Frequent	,,	in 50.1- 75 %	,,
Less frequent	,,	in 25.1- 50 %	,,
Isolated	,,	in 0.1- 25 %	,,

The dominancy is shown by the highest number found in 1000 gm. and by the average for each sample in which it is generally found.

According to the difference of country of origin of clover even the colour shows sundry differences determined by means of the relative quantity of yellow and violet grains. In consequence of this, it has been suggested to divide a determined number of grains into five different parts of " violet, prevailing violet, mixed, prevailing yellow and yellow " and to ascertain the percentage.

Samples to be examined must be submitted from quite trustworthy sources only and after various crops. Besides, different kinds of red clover, as, for instance, early and late clover, must be separately treated as explained with full particulars by A. VOLKART in the publication issued as a report on the Fourth Conference of the International Seed Testing Association, held at Cambridge (1). The researches on red clover respecting country of origin are therein assembled in similar lists and provided with an additional text by

(1) Published by His Majesty's Stationery Office, London, 1925.

Director K. DORPH-PETERSEN for Denmark, by Director A. W. FRANCK for Holland, by Director JOHN ENESCU for Roumania and by GUSTAV WIKSELL for Stockholms Län.

The following researches show the continuation of the work begun by A. VOLKART, retaining as far as possible his method of recording. A difficulty arose in publishing the lists with only one nomenclature. Following VOLKART's proposal, the different species should be named only according to the decisions of the International Botanical Congress at Vienna. In consequence of the different interpretations that our classifiers give to the idea of varieties and species and in consequence of the variable mode of writing, I followed chiefly modern and important botanical works and the *Index Kewensis*, placing meanwhile, in brackets, the different name used by the sender.

The text attached to each list can of course be founded only on the weed seeds studied therein and has therefore only a relative value. Only after the issue of a work, as far as possible complete, provided with numerous data respecting samples, and treating of all the countries of origin so far considered, will it be possible to give a connected table of the whole question. On the other hand, the results obtained up to the present time show a great increase of knowledge on the seed content of clover and lucerne from different countries. As the available space does not allow us to produce separately the list given by different districts of the same country, we have reserved them for use in a possible later work.

The following arrangements have been made for issuing the works:

(1) Director K. DORPH-PETERSEN, Copenhagen, on Danish, Hungarian, Polish, Czecho-Slovakian, Roumanian, French and Italian red clover seeds.

(2) Chief director, Court-counsellor Dr. v. DEGEN, Budapest, on Hungarian clover and lucerne seeds.

(3) K. LAVESON, on Swedish red clover from Oestergötland and Småland.

(4) Director Dr. E. KITUNEN, Helsinki, on Finland red clover seeds.

(5) Seed Laboratory, U. S. Department of Agriculture, Washington D.C. on red clover seeds from north, central and western U. S. of North America.

(6) Dr. F. WAHLEN, chief analyst, of the Seed Laboratory, on Canadian red clover seeds.

Thanks are due to them for their assistance.

Several other colleagues have already made known their wish to collaborate on this important question; we may therefore, in the near future, look for the issue of a continuation of the work.

Besides the researches carried out after VOLKART's plan, two works have been undertaken on the determination of the country of origin; they cannot be included in the limits of this publication and therefore follow separately in unchanged form.

LOUIS FRANCOIS: La détermination de la provenance des semences.
WALTER VON PETERY: *Beobachtungen und Forschungen der Fremden Samen (Unkrautsamen), die in den argentinischen Saaten enthalten sind, mit besonderer Berücksichtigung der Herkunft dieser, je nach Verbreitung der betreffenden Unkrautpflanzen in den verschiedenen Gegenden.*

Red clover from Denmark. At the Cambridge Conference Dr. VOLKART was enabled to report on an early research of DORPH-PETERSEN on the country of origin of Danish red clover. The statements made at that time are still valuable for the present researches. The weed flora given in the following list is that belonging to the northern part of middle Europe. Plants requiring warm arid soil are very scarce, if not altogether missing. There are found here separately: *Reseda luteola, Anthyllis Vulneraria, Medicago sativa, Salvia pratensis, Thrincia hirta, Crepis tectorum, Centaurea Scabiosa, Picris hieracioides,* all of which indicate a warmer, drier, somewhat more limy undersoil. Even *Silene dichotoma,* a plant which ought to be considered as continental, was found in two samples. Particularly interesting, as VOLKART already pointed out, is the rather frequent occurrence of *Trifolium striatum* in Danish red clover. This plant is chiefly to be found in Mediterranean lands and West Europe and appears, on the contrary, only very scattered and scarce in central Europe on soils having almost no lime or much salt. The following is worth notice: the very frequent occurrence of *Lolium perenne* and *L. multiflorum, Phleum pratense, Dactylis glomerata, Agropyrum repens, Bromus arvensis, Poa annua* and *P. trivialis* must partly be attributed to the extensive cultivation of these species in Denmark, partly however to the influence of the cool and damp climate of this country. Also the strong predominance of *Geranium dissectum, Geranium molle* and *Geranium pusillum* as well as of *Chrysanthemum inodorum* appears worth of notice.

Swedish red clover from Oestergötland and Småland. The weed content of both Swedish areas of origin from Oestergötland and Småland shows the composition that is characteristic of the North of central Europe and is also to be found in Danish seed in which those kinds are scarce that require a warm soil. Apart from such plants stand *Galeopsis Ladanum, Anthyllis Vulneraria,* and *Centaurea Scabiosa*; on the contrary *Galium tricorne,* is very frequent, a species originally indigenous to South Europe but is now more or less accustomed to the climate of especially warm places in central Europe. Its frequent occurrence in Swedish red clover fields has yet to be studied. In Danish, and still more in German seeds, various kinds of weeds are totally missing such as *Daucus Carota, Crepis tectorum, Sherardia arvensis, Trifolium striatum, T. procumbens* and *T. arvense, Silene inflata, Reseda luteola, Geranium pusillum, Scleranthus annuus,* etc. We cannot decide here if this fact is principally due to the more northerly position of these countries in regard to Denmark, or to the little amount of lime in the soil. The almost complete deficiency of *Dactylis glomerata, Lolium perenne* and *L. multiflorum* in Swedish seeds should be noted in comparison with Danish seeds in which these kinds occur very frequently.

The weight per thousand seeds of those coming from Oestergötland and Småland shows a noticeable conformity with that of Danish seeds. We note here in accordance with the result already obtained by Dr. VOLKART, that Danish, Dutch and Swedish clover show a dominance of the yellow colour. The regular occurrence of little stones, quartz, feldspar and hornblende is evidently very characteristic in these Swedish seeds and can be taken into consideration in determining the country of origin.

Red clover from Finland. In the weed flora of seeds coming from Finland, as in those coming from Stockholms Län, the influence of the northern climate is very noticeable. Species requiring warm regions are almost completely missing. *Plantago lanceolata* which occurs very frequently in Danish and in Swedish seeds from Småland is much less frequent in Swedish red clover samples from Oestergötland and appears only very rarely in those from Stockholms Län and from Finland. The interesting fact, noted by Dr. VOLKART, that in samples from Stockholms Län the persistent species prevail, is even more noticeable in red clover samples from

Finland. In Finland seed species are even to be found that in central Europe are indicative of specially damp meadows and marshes, e. g. *Stellaria palustris, Galium uliginosum, Filipendula Ulmaria, Achillea ptarmica, Juncus bufonius, Cirsium palustre.*

Very characteristic of Finland red clover is the very frequent occurrence of *Rumex domesticus* that is only to be found in isolated samples from Stockholms Län and can be considered as the indicator of Finland seeds. Worth noticing also is the frequent occurrence of *Galeopsis Tetrahit* and the less frequent of *Carum Carvi, Ranunculus acer* and *Lathyrus pratensis.*

The mineral content of the samples is very characteristic and when carefully studied is of great help in determining the country of origin.

Red clover and lucerne from Hungary. The weed flora of Hungary is composed partly of species from central Europe and universal plants, partly of species requiring warmth, as are also to be found in Italian and French seeds, partly of representatives of western and south-western Europe. Contiguous south-western Russia, Roumania and Jugoslavia have equal or similar characteristics and some of the weeds of western Europe go westward through Moravia, Bohemia, Austria, in the dry regions of western Germany.

On account of the frequency of occurrence of various species liking a warm climate it is not always an easy task, as STEBLER and VOLKART note, to distinguish Hungarian and other clover and lucerne seed of eastern Europe, from those of western and south Europe. But these kinds are also of a great help in determining the country of origin, as they respectively appear in the different regions in different proportions. Very characteristic in Hungarian seeds, and in those of the contiguous regions is the frequency of occurrence and the corresponding constancy and dominance of *Setaria viridis, Setaria glauca* and *Panicum Crus-galli.* Together with these are frequently found *Setaria germanica* and *Panicum miliaceum.* Other species liking warm soil are more frequent in seeds of eastern Europe than in the seeds of western and south Europe, in greatest quantity were found in the samples: *Chenopodium hybridum, Coronilla varia, Conium maculatum, Lappula echinata, Ballota nigra, Stachys annua, Cichorium Intybus* and in less quantity *Polycnemum majus, Delphinium Consolida, Nigella arvensis, Galega officinalis, Bupleurum tenuis-*

simum, *Galeopsis Ladanum* and others. The occurrence also of the Grobseide, *Cuscuta arvensis*, more frequent in Hungarian seeds than in those of western and south Europe, can be used as an indicator. *Hibiscus ternatus*, considered to be a variety of *Hibiscus Trionum* by one author and by another as an independent species and was, up to the present time, termed *Hibiscus Trionum* in the literature of the seed laboratory, is very characteristic of many Hungarian seeds even if it is more rare. We are rather surprised at the occurrence of *Picris echioides* (= *Helminthia echioides*), *Centaurea solstitialis* and *Crepis setosa*. Even if those species, especially both the last ones, can often be observed in Hungary as weeds, the occurrence of their seeds in clover and lucerne seeds suggested up to the present time, a French or Italian origin. Dr. v. DEGEN states in the additional text to his tables of the countries of origin that *Picris echioides* is to be found in lucerne fields of certain regions of Hungary. Also *Verbena officinalis* that, up to the present time, was considered as belonging more to western Mediterranean Atlantic regions, occurs frequently in the list of Hungarian red clover. *Lolium perenne* and *Lolium multiflorum* are, like other herbs, often very frequent in French seeds and become therefore characteristic. But *Lolium perenne* occurs also very frequently in Hungarian red clover lists as, together with *Lolium aristatum*, in the lucerne list. (*Lolium aristatum* is the commonly grown form lasting 2-3 years, of Italian Rye grass). In consequence of this the number is always more reduced of the chief species by means of which the clover and lucerne seeds of western Mediterranean-Atlantic regions differ from those of Hungary.

On the other hand, Hungarian seeds show, together with the above mentioned weeds liking warm soil, specific representatives of the west and south-west, which are missing in French and Italian countries of origin and were in part, up to the present time, altogether unknown for these regions as for instance, *Festuca pseudovina*, *Rumex stenophyllus*, *Brassica elongata*, *Trifolium parviflorum*, *Melampyrum barbatum*, *Salvia nemorosa*, *Anthemis ruthenica*, *Centaurea pannonica*, *C. micranthos*. Both the last species have also, as Director VOLKART stated at the Copenhagen International Conference, been found in Roumanian seeds by Director ENESCU, Bucharest. Unfortunately, of these species, only *Centaurea micranthos* and *Rumex stenophyllus* occur frequently in the list of Hungarian lucerne seeds, while they are missing in red clover. On the contrary, *Centaurea pannonica* and *Anthemis ruthenica* are to be found in red clover

seeds among the less frequent kinds, while the other species mentioned occur only in isolated cases and cannot therefore be considered as chief kinds. At all events, in the study of Hungarian seeds special attention should be given to all such species.

A typical representative of Eastern European weeds, *Silene dichotoma*, by means of frequent importation of Russian and Hungarian clover seeds has reached west and north to Bohemia, Silesia, Denmark and Finland, appearing also in North America, as the lists of the countries of origin of the United States of America ascertain. On the other hand, *Amarantus albus* and *A. retroflexus*, weeds originally coming from North America, have largely extended in Hungary and their seeds occur therefore very frequently and can be of great help in determining the country of origin. However, v. DEGEN states in his additional text that *Melilotus parviflorus*, considered in literature as Hungarian yellow clover seed, was never to be found in Hungarian seed and that he was also never able to find the plant among Hungarian weeds. On the other hand, in Hungarian lucerne is to be found the seed of *Trigonella Besseriana* Ser. (= *Melilotus procumbens* Bess.) that somewhat resembles the seed of *Melilotus parviflorus*. The plant does not occur very frequently on the sodium sandy soil of Hungary, but here and there in clusters. Its seeds were rather numerous in the corresponding lucerne seeds, and interesting also is the frequent occurrence of *Salsola Kali* in Hungarian lucerne seeds. This occurs because the soil of the Hungarian plain contains, here and there, a greater quantity of salt.

Even if it is rather difficult, according to the above mentioned works, to distinguish Hungarian from French and Italian seeds and especially to recognize mixtures of both, the examination of the whole seed flora as it appears in the lists, gives a reliable table. According to my own experience, the presence of typical small lumps of earth is of great help, in determining Hungarian seeds. A great quantity of these seeds comes from the region of the Hungarian plain, which is covered with black earth. In the samples it has the form of little round lumps. It differs from the one which occurs in Russian seeds, because the Hungarian particles are more closely united and often show a slightly glossy brilliancy. According to a communication of Councillor v. DEGEN, the difference proceeds from the fact that Hungarian black earth contains sodium.

Red clover from the United States of North America. The table sent by the Seed Laboratory,

U. S. Department of Agriculture, Washington, D. C., shows in alphabetical order the weed seeds of 133 red clover samples from 14 States and the average number per 1000 gm., as found for each State. Unfortunately, space does not allow us to produce the 14 lists; they are, in consequence of this, assembled in one list But the memorandum attached to the work has been published without any alteration. It shows in what class the weed content of each State differs and is a compensation for the single lists.

In comparing the following classification of weed seeds with what, in the first International Conference for Seed Testing, of 1907, STEBLER stated to be characteristic of North American origin, we notice a very considerable increase in our knowledge concerning the weed flora of this region. In these American species very frequently occur: *Plantago Rugelii* and *Ambrosia artemisiaefolia*, less frequently: *Panicum capillare, Euphorbia Preslii, Acalypha virginica, Physalis* sp. The following kinds are to be found isolated: *Panicum dichotomiflorum, Panicum Gattingeri, Panicum lanuginosum, Panicum barvipulvinatum, Sporobolus clandestinus, S. neglectus, S. cryptandrus, Paspalum setaceum, Danthonia spicata, Cenchrus tribuloides, Polygonum pennsylvanicum, Rumex salicifolius, Chenopodium leptophyllum, Amaranthus blitoides, Salsola pestifer, Mollugo verticillata, Lepidium densiflorum, L. virginicum, Linum virginianum, Euphorbia maculata, Cuphea petiolata, Oenothera heterophylla, Verbena urticifolia, V. angustifolia, V. hastata, Hedeoma pulegioides, Lycopus virginicus, Dracocephalum parviflorum, Trichostema dichotomum, Teucrium canadense, Solanum carolinense, Plantago aristata, Veronica peregrina, Lobelia inflata, Rudbeckia hirta.*

Red clover from Canada. The weed content of Canadian seeds does not contain so many species as in the case of seeds from the United States of America. Out attention is first of all called to the fact that, in the American chief species only *Plantago Rugelii* and *Ambrosia artemisiaefolia* are to be found, and isolated *Sisyrinchium* sp., *Decodon verticillatum* and *Silene antirrhina.*. Of the kinds more frequent in the red clover samples of the United States, are missing here: *Amaranthus* sp., *Andropogon Ischaemon, Daucus Carota, Euphorbia Preslii, Physalis* sp. *Acalypha virginica, Panicum capi llare.*

Comparing the weed contents of the United States and Canada with European red clover seeds, we notice that a great many Euro-

pean species are also to be found among the American seeds, with the same frequency of occurrence as, for instance, *Setaria glauca* and *S. viridis*, *Rumex crispus* and *R. Acetosella*, *Polygonum Persicaria*, *Chenopodium album*, *Plantago lanceolata*, *Cirsium arvense*, etc. On the other hand, a certain number of species and varieties frequently occurring in Europe are totally missing. We cannot find in American lists our species of *Geranium*, *Vicia*, *Galium* and *Centaurea*, *Sherardia arvensis*, *Carum Carvi*, *Sinapis arvensis*, *Convolvulus arvensis*, *Lapsana communis*, *Matricaria inodora*, *Agropyrum repens*. The western and south European chief kinds such as *Coronilla scorpioides*, *Helminthia echioides*, *Picris stricta*, *Thrincia hirta*, *Trifolium supinum*, etc., are also missing. *Ranunculus repens*, *Spergula arvensis*, *Lolium multiflorum* and *Lolium* sp. were only present in every other of the 133 samples of the United States, and in those of Canada are missing; *Cichorium Intybus* is only to be found in isolated cases. The occurrence of *Heleocharis palustris* and *Heleocharis ovata* in American clover seeds is surprising. These plants appear in Europe only in marshes and very damp meadows, on the border of pools or in emptied reservoirs, but never in clover fields.

We possess data respecting samples from Poland, Czechoslovakia, Roumania, Italy and France, but as they do not supply any general conclusions they are only published in the lists as supplements.

LIST I.

Red clover from Denmark.

Examined by DORPH-PETERSEN, Director of Staatsfrökontrollen, Copenhagen.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent:			
Anthemis arvensis L.	39	138 000	7 800
Lolium perenne L. and *L. multifl.* Lam.	38	31 840	6 414
Rumex crispus L.	38	12 200	1.170
Trifolium hybridum L.	38	5 160	285
Medicago lupulina L.	38	4 000	574
Geranium dissectum L.	39	2 000	197
Cirsium arvense (L.) Scop.	38	2 000	259
Chenopodium album L.	37	6 000	1 461
Plantago lanceolata L.	37	3 480	449

	Number of semples	Maximum per 1000 gm	Average per 1000 gm
Very frequent:			
Rumex acetosella L.	35	259 560	8 480
Phleum pratense L.	34	42 600	1 350
Trifolium repens L.	33	6 760	528
Sherardia arvensis L.	33	272	46
Dactylis glomerata L.	32	20 400	1 102
Geranium Molle L.	32	693	62
Chrysanthemum inodorum L. (= *Matricaria inodora* L.)	32	8 640	648
Agropyrum repens Krause (= *Triticum repens* L.)	31	4.760	333
Sinapis arvensis L.	31	1 800	245
Frequent species:			
Brunella vulgaris L.	29	21 200	174
Stellaria media (L) Vill.	28	2 160	143
Daucus Carota L.	27	17 000	1 041
Plantago major L.	24	14 920	1 613
Polygonum aviculare L.	23	773	64
Geranium pusillum L.	21	1 020	102
Bromus arvensis L.	20	10 240	626
Less frequent species:			
Poa annua L. a. *P. trivialis* L.	19	33 333	5.848
Agrostis alba L.	19	59 760	5.670
Viola tricolor L.	19	291	32
Myosotis arvensis Pers.	19	1 140	116
Spergula arvensis L.	19	2 280	306
Trifolium striatum L.	18	987	96
Cerastium caespitosum Gil.	16	1 480	399
Senecio vulgaris L.	17	520	88
Scleranthus annuus L.	14	333	32
Ranunculus repens L.	14	580	56
Cirsium lanceolatum (L) Hill.	15	72	14
Silene inflata Smith.	15	420	69
Capsella Bursa-pastoris Med.	13	680	162
Lotus corniculatus L.	13	1 200	110
Anagallis arvensis L.	14	12	6
Chrysanthemum Leucanthemum L.	13	2 240	355
Achillea Millefolium L.	12	1 300	354
Lolium perenne L.	11	31 840	6 414
Veronica Tournefortii Gmel.	11	112	36
Chrysanthemum segetum L.	13	360	83
Lapsana communis L.	10	570	73

Isolated species :	Number of samples	Maximum per 1000 gm	Average per 1000 gm
Alchemilla arvensis Scop.	10	640	97
Galium Mollugo L.	10	76	18
Carex div. spec. (*caespitosa* L., *muricata* L., *rostrata* With., etc.)	8	773	88
Festuca pratensis Huds.	9	1 080	153
Arenaria serpyllifolia L	8	340	100
Trifolium procumbens L.	9	120	21
Galium Aparine L.	8	72	18
Veronica arvensis L. a. *V. Chamaedrys* L.	8	813	106
Cichorium Intybus L.	8	2 680	366
Leontodon autumnalis L.	8	1 560	223
Avena sativa L.	8	24	8
Brassica campestris L.	7	172	42
Holcus lanatus L.	7	173	43
Festuca ovina L., *duriuscula* Koch.	6	52	22
Bromus mollis L. a. *Br. commutatus* Schr	6	128	29
Atriplex patulum L.	7	260	54
Melandryum album Garcke (= *Lychnis alba* Mill.)	6	112	28
Papaver dubium L. a. *P. Argemone* L.	6	5 622	1.200
Triticum vulgare Vill.	6	12	6
Centaurea Cyanus L.	6	52	26
Sonchus asper All.	5	133	62

In 4 samples were found :

Secale Cereale L. (4), *Polygonum Convolvulus* L. (44), *Rumex acetosa* L. (104), *Stellaria graminea* L. (356), *Trifolium arvense* L. (7), *Trifolium agrarium* L. (10), *Anthyllis Vulneraria* L. (13), *Erodium cicutarium* L'Herit. (14), *Reseda luteola* L. (353), *Potentilla procumbens* Sbth. (5), *Echium vulgare* L. (22), *Taraxacum officinale* Web. (4), *Crepis virens* Vill. (83), *Centaurea Scabiosa* L. (5), *Sonchus arvensis* L. (16).

In 3 samples were found :

Alopecurus geniculatus L. (8), *Polygonum tomentosum* Schr. (8), *Ranunculus flamula* L. (4), *Ranunculus sardous* Cr. (= *R. Philonotis* Ehrh.) (123), *Barbaraea vulgaris* R. Br. (200), *Sinapis alba* L. (22), *Rubus* sp. (4), *Convolvulus arvensis* L. (4), *Odontites rubra* L. (192), *Stachys paluster* L. (6), *Anchusa officinalis* Garke (4), *Valerianella dentata* Poll. (4), *Bellis perennis* L. (17), *Carduus acanthoides* L. (41), *Artemisia vulgaris* L. (69), *Hypochaeris radiata* L. (40), *Crepis tectorum* L. (6).

In 2 samples were found:

Arrhenatherum elatius M. a. K. (= *Avena elatior* L.) (37), *Secale cereale* L. (9), *Luzula campestris* D. C. (6), *Polygonum Persicaria* L. (10), *Silene dichotoma* Ehrh. (36), *Lychnis* sp. (20), *Dianthus* sp. (4), *Thlaspi arvense* L. (4), *Lepidium campestre* R. Br. (4), *Medicago sativa* L. (6), *Trifolium minus* *Relh.* (8), *Potentilla argentea* L. (409), *Potentilla reptans* L. (16), *Carum Carvi* L. (394), *Veronica hederifolia* L. (6), *Lithospermum arvense* L. (4), *Lamium amplexicaule* L. (54), *Lamium purpureum* L. (4), *Anthemis Cotula* L. (5), *Sonchus oleraceus* L. (6).

In 1 sample were found:

Airopsis sp. (17), *Triodia decumbens* P. B. (8), *Triticum* sp. (4), *Hordeum* sp. (4), *Anthoxanthum* sp. (4), *Lolium temulentum* L. (4), *Vulpia* sp. (4), *Cynosurus cristatus* L. (9), *Deschampsia caespitosa* P. B. (= *Aira caespitosa*, L.) (8) *Bromus* sp. (72), *Alopecurus pratensis* L. (4), *Rumex* sp. (4), *Urtica dioica* L. (4) *Polygonum lapathifolium* L. (4), *Polygonum* sp. (4), *Erucastrum Pollichii* Sch. et Sp. (4), *Berteroa incana* D. C. (309), *Raphanus Raphanistrum* L. (36), *Neslea paniculata* Desv. (4), *Sisymbrium officinale* Scop. (630), *Erophila verna* F. M. (= *Draba verna* L.) (8), *Ornithopus sativus* Brot. (4), *Melilotus* sp. (4), *Malva silvestris* Fries. (4), *Chaerophyllum temulentum* L. (4), *Anthriscus silvestris* Hof. (6), *Torilis Anthriscus* Gemel. (27), *Alectorolophus minor* Wimm. et Gr. (= *Rhinanthus minor* Ehrh.) (12), *Veronica Tournfortii Gmel.* (4), *Salvia pratensis* L. (28), *Lamium* sp. (8), *Menta arvensis* L. (9), *Galeopsis dubia* Leers. (4), *Stachys annus* L. (4), *Arctium Lappa* L. (12), *Centaurea Jacea* L. (4), *Picris hieracioides* L. (4), *Achillea ptarmica* L. (4), *Artemisia vulgaris* L. (9), *Thrincia hirta* Roth. (12), *Anthemis tinctoria* L. (12), *Anthemis Cotula* L. (5).

The following were also found: *Claviceps purpurea* Tul. in 15 samples (average 43), *Sclerotinia Trifoliorum* Ericks. in 19 samples (average 14), *Typhula trifolii* Rostr. in 12 samples (average 11), other *Sclerotinia* in 4 samples (average 45), *Tilletia Holci* Rostr. in 1 sample (4).

In other mixtures were found: Earth, small stones, hull fragments of grain, wasp chrysalis, other chrysalises, larvae and parts of other insects.

Weight per thousand gm: The weight per thousand gm. varies from 1.18 to 1.82 gm. and amounts on an average to 1.58 gm.

Colour: The colour has the following percentage average:

	Violet	Prevailing violet	Mixed Violet and yellow	Prevailing yellow	Yellow	Brown	Green
Minimum	0.3	13.1	5.6	4.9	8.2	3.7	0.1
Maximum	2.8	40.4	28.5	37.8	32.5	26.4	1.9
Average	1.2	24.7	20.0	20.9	19.1	13.5	0.6

The data are derived from 39 samples as regards the weed content, from 10 samples as regards the colour and the weight per thousand gm.

LIST II.

Swedish red clover from Oestergötland

Examined by K. LABESON, Director of the Oestergötlands läns Frökontrollanstalt Linköping.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species:			
Phleum pratense L.	21	95 880	12 819
Trifolium hybridum L.	21	77 920	17 819
Rumex crispus L.	20	3 000	401
Frequent species:			
Chenopodium album L.	16	1 080	164
Medicago lupulina L.	14	19 480	3 674
Polygonum aviculare L.	13	152	47
Sinapsis arvensis L.	13	2 280	293
Galium tricorne Stokes	13	164	39
Less frequent species:			
Thlaspi arvense L.	11	788	136
Lapsana communis L.	11	380	51
Lychnis flos cuculi L.	10	380	75
Plantago lanceolata L.	10	10 560	2 278
Cirsium arvense (L.) Scop.	9	188	57
Brunella vulgaris L.	9	272	55
Barbaraea vulgaris R. B.	8	2 480	506
Stellaria media (L.) Vill.	8	748	183
Agropyrum repens Krause (= *Triticum repens* L.).	7	136	43
Rumex acetosella L.	7	274	93
Spergula arvensis L.	6	160	46
Vicia hirsuta J. F. Gray	6	34	13
Chrysanthemum inodorum L. (= *Matricaria inodora* L.)	6	2.560	491
Isolated species:			
Silene nutans L.	5	4 320	1 004
Carduus crispus L.	5	1 200	312
Polygonum lapathifolium L.	4	114	35
Stellaria graminea L.	4	48	18

Isolated species:	Number of samples	Maximum per 1000 gm	Average per 1000 gm
Anthriscus silvester Hoff.	4	13	8
Myosotis arvensis Hill.	4	104	43
Anthemis arvensis L.	4	732	189
Anthemis tinctoria L.	4	188	106
Carex sp.	3	24	13
Poa pratensis L	3	264	176
Ranunculus repens L.	3	28	13
Viola tricolor L.	3	26	12
Trifolium repens L.	3	24	13
Chrysanthemum Leucanthemum L.	3	28	19
Achillea millefolium L.	3	68	38
Carex hirta L.	2	12	11
Carex muricata L.	2	10	7
Luzula campestris Lam. a. D. C.	2	6	6
Atriplex patulum L.	2	244	184
Cerastium arvense L.	2	12	6
Delphinum consolida L.	2	34	23
Papaver argemone L.	2	28	22
Sisymbrium officinale Scop.	2	148	91
Capsella Bursa-pastoris Medicus	2	44	25
Lepidium campestre R. Br.	2	40	24
Rubus fruticosus L.	2	4	4
Carum Carvi L.	2	12	9
Aethusa Cynapium L.	2	96	54
Pimpinella Saxifraga L.	2	6	6
Galium verum L.	2	20	16
Plantago major L.	2	24	15
Odontites rubra L.	2	28	17
Lamium amplexicaule L.	2	12	9
Centaurea cyanus L.	2	6	5
Sclerotien	2	4	4

Found only in one sample: *Festuca pratensis* Huds. (=*F. elatior* L.) (4), *Festuca ovina* L. (28), *Agrostis alba* L. (= *A. stolonifera*) (84), *Polygonum Convolvulus* L. (40), *Polygonum Persicaria* L. (6), *Arenaria serpyllifolia* L. (28), *Camelina sativa* Cr. (6), *Potentilla argentea* L. (24), *Geranium Molle* L. (6), *Geranium dissectum* L. (13), *Anthyllis vulneraria* L. (20), *Linum usitatissimum* L. (4), *Lithospermum arvense* L. (8), *Galeopsis Tetrahit* L. (120), *Galeopsis Ladanum* L. (4), *Cirsium lanceolatum* (L.) Hill. (20), *Centaurea Scabiosa* L. (34), *Leontodon autumnalis* L. (12), *Specularia* sp. (6).

Found in other mixtures: Brown earth, light and darker earth, small pieces of quartz, feldspar, hornblende, clay on the average 0,62 %.

The colour has the following average percentage:

	Violet	Prevailing violet	Prevailing yellow	Yellow
Maximum	30.4	27.5	21.5	52.8
Minimum	12.4	12.9	8.0	28.8
Average	22.3	19.0	15.4	43.3

The weight per thousand gm. varies from 1.94 gm. to 1.37 gm. and amounts as an average to 1.72.

The data is based on 22 samples from the 1921 and 1922 harvests.

Swedish red clover from Småland.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species:			
Phleum pratense L.	5	692	189
Rumex crispus L.	5	1 300	296
Trifolium hybridum L.	5	15 200	4 571
Plantago lanceolata L.	5	4 600	1 896
Trifolium repens L.	4	112	34
Frequent species:			
Chenopodium album L.	3	300	112
Less frequent species:			
Rumex Acetosella L.	2	48	26
Polygonum aviculare L.	2	28	20
Sinapis alba L.	2	112	61
Vicia hirsuta S. F. Gray	2	20	12
Brunella vulgaris L.	2	12	9
Centaurea Cyanus L.	2	40	26

Isolated species: Found in only one sample: *Poa pratensis* L. (210), *Dactylis glomerata* L. (20), *Agropyrum repens* Krause (= *Triticum repens* L.) (9), *Carex muricata* L. (4), *Polygonum lapathifolium* L. (6), *Polygonum Convolvulus* L. (40), *Barbaraea vulgaris* R. Br. (6), *Thlaspi arvense* L. (6), *Lepidium campestre* R. Br. (92), *Medicago lupulina* L. (12), *Anthyllis Vulneraria* L. (92), *Silene nutans* L. (12), *Lithospermum arvense* L. (4), *Brunella vulgaris* L. (12).

In other mixtures were found: Fragments of corn, clay, small pieces of quartz, feldspat, and hornblende, average 0.46 gm.

Weight per thousand gm.: The weight per thousand gm. varies between 1.46 gm. and 1.94 gm. and amounts in average to 1.72 gm.

Colour: The colour has the following average percentage:

	Violet	Prevailing violet	Prevailing yellow	Yellow
Maximum	16.9	34.4	20.3	47.4
Minimum	11.4	22.0	15.7	33.6
Average	14.1	27.8	18.2	39.9

The experiments were carried out on 5 samples of the 1922 crop.

List III.

Red clover from Finland.

Examined by Dr. E. Kitunen, Director of the State Institute for Seed Testing in Finland.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species:			
Trifolium hybridum L.	129	83 594	6 306
Phleum pratense L.	127	286 957	16 236
Chenopodium album L.	105	4 280	288
Rumex domesticus Hn.	99	2 520	95
Spergula arvensis L.	99	9 000	327
Frequent species:			
Galeopsis Tetrahit L.	89	973	81
Rumex Acetosella L.	80	61 440	2 618
Trifolium repens L.	78	10 120	1 061
Ranunculus repens L.	72	2 480	149
Less frequent species:			
Polygonum lapathifolium L.	64	1 108	62
Carum Carvi L.	63	255	32
Stellaria media (L.) Vill.	60	3 320	146
Polygonum aviculare L.	59	108	16
Rumex crispus L.	57	3 560	171
Brunella vulgaris L.	53	4 000	277

	Number of samples	Maximum per 1000 gm	Average per 1000 gm
Less frequent species:			
Poa sp. (preferably *pratensis* L., *nemoralis* L., *trivialis* L. and *annua* L.)	53	6 400	216
Ranunculus acer L.	47	340	40
Vicia tetrasperma (L.) Moench.	45	11 640	408
Lapsana communis L.	44	369	35
Centaurea Jacea L.	44	744	94
Luzula campestris (L) D. C.	42	1 840	137
Agrostis sp. (preferably *vulgaris* With. and *canina* L.)	42	10 640	700
Cirsium arvense (L.) Scop.	42	156	21
Viola tricolor L.	42	216	29
Thlaspi arvense L.	41	760	90
Festuca pratensis Huds. (= *F. elatior* L).	40	368	24
Chrysanthemum inodorum L. (= *Matricaria inodora* L.)	38	1 040	76
Festuca rubra L.	36	314	47
Chrysanthemum Leucanthemum L.	36	1 680	142
Linum usitatissimum L.	35	680	65
Lathyrus pratensis L.	33	326	26
Isolated species:			
Deschampsia caespitosa (L)	—	—	—
P. B. (= *Aera caespitosa* L.)	32	760	80
Galium Aparine L.	29	188	31
Leontodon autumnalis L.	29	1 320	106
Stellaria palustris (Murr.) Retz.	28	560	73
Galium Mollugo L.	28	1 920	103
Anthemis arvensis L.	27	297	31
Aegopodium Podagraria L.	24	80	32
Vicia hirsuta (L.) S. F. Gray	24	80	14
Achillea Millefolium L.	23	246	30
Cirsium lanceolatum (L.) Hill.	22	132	25
Centaurea Cyanus L.	21	36	10
Atriplex patulum L.	20	2 760	172
Agropyrum repens Krause (= *Triticum repens* L.)	19	16	6
Anthriscus silvester (L.) Hoffm.	18	116	26
Brassica campestris L.	17	245	26
Alectorolophus major (*Ehrh.*) Rehb. and *A. minor* (Erhh.) Wimm. a. Gr. (= *Rhinanthus maior* and *minor* Ehrh.)	17	2 160	223

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Less frequent species:			
Pimpinella saxifraga L.	16	96	22
Myosotis arvensis (L.) Hill. (= *M. intermedia Link*)	15	180	29
Bromus secalinus L.	14	28	9
Carex sp.	13	12	8
Erysimum cheiranthoides L.	12	76	23
Rumex acetosa L.	12	30	11
Galium uliginosum L.	11	1 440	143
Barbarea vulgaris R. Br.	10	520	80
Ranunculus auricomus L.	9	104	18
Stellaria graminea L. and *Cerastium caespitosum* Gilib. (= *C. vulgare*)	9	223	59
Alopecurus geniculatus L.	8	45	14
Alopecurus pratensis L.	7	6	4
Polygonum Hydropiper L.	7	28	8
Potentilla Tormentilla Libth.	7	8	5
Filipendula Ulmaria (L.) Max. (= *Ulmaria pentapetala* Gil.)	7	24	9
Plantago maior L.	7	23	11
Stachys paluster L.	7	16	6
Festuca ovina L.	6	8	5
Rubus sp.	6	8	5
Vicia Cracca L.	6	12	6
Anthemis tinctoria L.	6	48	12
Anthoxanthum odoratum L.	5	28	14
Melandrium album (Mill.) Garcke (= *Lychnis alba* Mill.)	5	177	30
Scleranthus annuus L.	5	36	18
Potentilla argentea L.	5	24	9
Apera Spica venti (L.) P. B.	4	8	7
Trifolium spadiceum L.	4	40	15

In 3 samples: *Dactylis glomerata* L. (9), *Juncus bufonius* L. (677), *Camelina sativa* (L.) Crantz s. sp., *Alyssum* (Mill.) Thell. (= *C. linicola* Sch. et Spenn.) (8), *Potentilla norvegica* L. (21), *Galium verum* L. (44), *Veronica chamaedrys* L. (26), *Galeopsis speciosa* Mill. (5), *Achillea ptarmica* L. (4).

In 2 samples: *Fumaria officinalis* L. (6), *Lychnis Flos-cuculi* L. (8), *Silene dichotoma* Ehrh. (64), *Melandrium rubrum* Garcke (=*Lychnis rubra* (L). *P.M.E.* (34), *Viola canina* L. (6), *Medicago lupulina* L. (4), *Cirsium palustre* (L.) Scop. (6), *Sonchus arvensis* L. (4), *Crepis tectorum* L. (72), *Taraxacum officinale* Web. (38).

In 1 sample : *Polygonum Convolvulus* L. (12), *Raphanus Raphanistrum* L. (7), *Plantago lanceolata* L. (32), *Euphrasia officinalis* L. (4), *Hieracium umbellatum* L. (6).

In 44 % of the samples *Claviceps* sp. was found, sometimes also *Sclerotinia Trifoliorum* Erikss. and rarely *Typhula Trifolii* Rostr. Chrysalises of different forms are often found here, but cannot be determined ; the most frequent is an oval and brown chrysalis, about 3 mm. long and having a white band.

Small pieces of grain, mostly rye, are sometimes to be found.

The data of the research are compiled from 130 samples as regards the weed content, from 58 samples as regards the mineral content.

Minerals :

Minerals	Number of samples in which the mineral was contained	Maximum percentage of grains in the total amount of mineral	Average percentage of grains in the total amount of mineral	
Quartz (1)	57	60	25	Microscopic dust of stones and grey clay. Sometimes also brick earth.
Feldspar (2)	57	42	17	
Mica (3)	11	3	2	
Quartz-feldspar-mica (4)	58	100	15	
Mica-amphibole-Pyroxene (5)	50	37	13	

(1) Generally white-grey, light watery-grey.

(2) Contains two kinds, hardly separated ; Potash-feldspar, of a light brown or reddish colour and plagioclase, soda-lime feldspar which are white, whitish or grey.

(3) Is exclusively composed of dark biotite mica.

(4) Particles containing these elements have been grouped together. The group contains chiefly granite and gneiss ; the chemical composition is almost the same as that of quartz granite.

(5) Contains particles of dark minerals of biotite or amphibole and pyroxene, chiefly of mica-schists with a large quantity of mica and other dark schists, and only few igneous, fundamental rocks having the same chemical composition.

The sand grains are square or slightly rounded.

List IV.

Red clover from Hungary.

Examined by Court Councillor Dr. v. Degen Chief Director of the State Institute for Seed Testing, Budapest.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species:			
Lolium perenne L.	8	600	190
Setaria glauca (L.) R. et Sch.	8	200	114
Setaria viridis (L.) R. et Sch.	8	351	700
Polygonum aviculare L	8	100	41
Chenopodium album L.	8	1 110	485
Trifolium hybridum L.	8	1 200	368
Medicago lupulina L.	8	900	307
Daucus Carota L.	8	7 800	3 150
Cuscuta arvensis Beyr. *v. calycina* Engelm.	8	10 200	3 164
Cuscuta trifolii Bab.	8	29 800	12 912
Plantago lanceolata L.	8	43 700	23 713
Cichorium Intibus L.	8	1 300	725
Panicum Crus-galli L. (= *Echinochloa Crus-galli* L.) R. et Sch.	7	100	53
Rumex Acetosa L.	7	600	207
Medicago sativa L.	7	5 000	1 957
Trifolium repens L.	7	4 500	247
Frequent species:			
Atriplex hastatum L. a. *A. patulum* L.	6	500	170
Anagallis arvensis L.	6	200	61
Verbena officinalis L.	6	1 400	28
Digitaria sanguinalis (L.) Scop.	5	100	66
Silene dichotoma Ehrh.	5	300	126
Rumex Acetosella L.	5	200	120
Melilotus officinalis L.	5	400	184
Convolvulus arvensis L.	5	200	50
Brunella vulgaris L.	5	1 000	440
Chrysanthemum inodorum L. (= *Matricaria inodora* L.	5	100	52
Less frequent species:			
Amarantus retroflexus L.	4	200	62
Sinapis arvensis L.	4	200	63
Lotus corniculatus L.	4	400	180
Echium vulgare L.	4	200	85

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Less frequent species:			
Cirsium arvense (L.) Scop.	4	600	185
Reseda lutea L.	3	200	113
Trifolium arvense L.	3	300	140
Coronilla varia L.	3	100	47
Conium maculatum L.	3	40	20
Myosotis arvensis (L) Hill.	3	200	76
Stachys annua L.	3	100	46
Galium Aparine L.	3	100	40
Anthemis ruthenica M. B.	3	400	170
Centaurea pannonica (Heuff.) Simk.	3	50	40
Crepis setosa Hall. fil.	3	200	103
Lactuca saligna L.	3	100	70
Isolated species:			
Scleranthus annuus L.	2	10	10
Melandrium album (Mill.) Garcke	2	200	120
Ranunculus sardous Cr. (= *R. Philonotis* Ehrh.)	2	40	30
Nigella arvensis L.	2	100	100
Delphinium Consolida L.	2	10	10
Anthyllis Vulneraria L.	2	10	10
Galega officinalis L.	2	30	20
Torilis arvensis (Huds.) Gren.	2	10	10
Galeopsis Ladanum L.	2	100	55
Calamintha Acinos (L.) Clairv.	2	10	10
Melampyrum barbatum W. K.	2	10	10
Anthemis Cotula L.	2	100	100
Centaurea Cyanus L.	2	100	60
Carduus acanthoides L.	2	100	60

The following were found in 1 sample:

Bromus secalinus L. (100), *Festuca pseudovina* Hack. (10), *Polycnemum majus* A. Br. (10), *Vaccaria parviflora* Mnch. (20), *Thlaspi arvense* L. (20), *Lepidium Draba* L. (50), *Lepidium campestre* (L) R. Br. (200), *Erysimum repandum* L. (30), *Camelina microcarpa* Andrez. (10), *Rubus caesius* L. (10), *Vicia angustifolia* L. (10), *Lathyrus Aphaca* L. (10), *Hibiscus ternatus* Cav. (10), *Viola arvensis* Murr. (100), *Thymelaea Passerina* (L.) Coss. (10), *Lythrum hyssopifolia* L. (40), *Chaerophyllum bulbosum* L. (100), *Pimpinella Saxifraga* L. (100), *Lappula echinata* Gilib. (= *Echinospermum Lappula* Lehm.) (10) *Lithospermum arvense* L. (40), *Lamium amplexicaule* L. (10), *Salvia nemorosa* L. (200), *Sideritis montana*, L. (10), *Solanum nigrum* L. (10), *Kickxia Elatine*

(L.) Durn. (40), *Galium Mollugo* L. (100), *Valerianella dentata* Poll. (10), *Anthemis austriaca* Jacqu. (100), *Chrysanthemum Leucanthemum* L. (10), *Picris hieracioides* L. (300), *Sonchus arvensis* L. (10), *Sonchus laevis* (L.) Vill. (200).

The examination was based on 8 samples of 100 gm. and calculated to 1000 gm.

Lucerne from Hungary.

Examined by Court Councillor Dr. v. DEGEN, Chief Director of the Institute for Seed Testing, Budapest.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species:			
Setaria viridis (L.) R. et Sch.	8	18 900	11 580
Panicum miliaceum L.	8	290	105
Panicum Crus galli L. (= *Echinochloa Crus-galli* (L.) R. et Sch.)	8	820	229
Atriplex hastatum L. a. *A. patulum* L.	8	6 400	1 294
Chenopodium album L.	8	20 000	5 348
Polygonum aviculare L.	8	360	232
Coronilla varia L.	8	360	195
Trifolium pratense L.	8	18 800	4 488
Lotus corniculatus L.	8	980	351
Plantago lanceolata L.	8	3 980	1 756
Stachys annua L.	8	140	54
Setaria germanica (Mill.) P. B.	7	170	51
Lolium aristatum Lag. a. *L. perenne* L.	7	650	224
Malva neglecta Wallr.	7	120	43
Daucus Carota L.	7	420	124
Cichorium Intibus L.	7	1 830	352
Frequent species:			
Chenopodium hybridum L.	6	5 080	860
Melilotus officinalis L.	6	34 800	11 805
Ballota nigra L.	6	60	26
Digitaria sanguinalis (L) Scop.	5	60	24
Rumex stenophyllus Led.	5	260	88
Melandrium album (Mill.) Garcke	5	230	74
Medicago lupulina L.	5	60	38
Cuscuta trifolii Bab.	5	3 600	798
Amarantus albus L. a. *A. retroflexus* L.	4	680	250
Polycnemum majus A. Br.	4	20	12
Trifolium repens L.	4	140	62
Lappula echinata Gilib.	4	50	27

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Frequent species:			
Setaria glauca (L.) R. et Sch.	3	4 330	1 516
Salsola kali L.	3	100	40
Sinapis arvensis L.	3	310	126
Bupleurum tenuissimum L.	3	60	30
Conium maculatum L.	3	20	20
Solanum nigrum L.	3	60	27
Cuscuta arvensis Beyr. v. *calycina* Engelm.	3	430	153
Brunella vulgaris L.	3	50	23
Centaurea micranthos G.	3	30	17

The following were found in 2 samples: *Polygonum Convolvulus* L. (20), *Stellaria media* (L.) Voll. (10), *Delphinium Consolida* L. (15), *Brassica campestris* L. (215), *Lepidium Draba* L. (10), *Thalaspi arvense* L. (15), *Trifolium parviflorum* Ehrh. (10), *Vicia tetrasperma* (L) Mnch. (15), *Geranium pusillum* Burm. (10), *Falcaria vulgaris* Bernh. (15), *Verbena officinalis* L. (40), *Aiuga Chamaepitys* (L.) Schreb. (20), *Sideritis montana* L. (20), *Kickxia spuria* (L.) Dum. (15), *Galium Aparine* L. (30), *Galium tricorne* With (10).

Found in 1 sample: *Sorghum vulgare* Pers. (20), *Rumex Acetosa* L. (30), *Nigella arvensis* (10), *Brassica elongata* Ehrh. (10), *Capsella Bursa-pastoris* L. (170), *Reseda lutea* L. (10), *Trifolium fragiferum* L. (20), *Trifolium arvense* L. (50), *Trifolium striatum* L. (10), *Trifolium hybridum* L. (10), *Erodium cicutarium* (L.) L'Herit. (10), *Hibiscus ternatus* Cav. (10), *Pimpinella saxifraga* L. (80). *Lithospermum arvense* L. (20), *Galium verum* L. (10), *Salvia verticillata* L. (40), *Anthemis arvensis* L. (10), *Matricaria inodora* L. (40), *Centaurea pannonica* (Heuff.), Simck. (170), *Centaurea solstitialis* L. (20), *Cirsium arvense* (L.) Scop. (50), *Picris hieracioides* L. (40).

The examination was based on 8 not cleaned samples of 100 gm. and calculated to 1000 gm.

Red clover from Hungary.

Sent by Court Councillor Dr. v Degen, examined by Director Dorph-Petersen, Copenhagen.

The examination was made on 2 samples of 100 gm. and calculated to 1000 gm:

Average found: *Panicum Crusa-glli* L. (12), *Setaria viridis* (L.) P. B. and *S. panicea* Schinz et Thell. (47), *Rumex crispus* L. (32), *Polygonum aviculare* L. (20), *Chenopodium album*. L. (18), *Lepidium Draba* L. (244), *Thlaspi arvense* L. (25), *Medicago sativa* L. (1437), *Lotus corniculatus* L. (40), *Plantago lanceolata*

L. (3110), *Anagallis arvensis* L. and *A. caerulea* Schreb. (110), *Lappula echinata* Gil. (= *Echinospermum Lappula* Schm.) (25).

Found in 1 sample: *Panicum sanguinale* L. *Panicum violaceum* Rottl. (5), *Panicum* sp. peeled (5), *Lolium* sp. (115), *Hordeum iubatum* D. C. (5), *Polygonum Convolvulus* L. (5), *Atriplex patulum* L. (20), *Delphinium* sp. (35), *Silene inflata* Smith (10), *Sinapsis arvensis* L. (45), *Trifolium repens* L. (5), *Trifolium hybridum* L. (5), *Trifolium fragiferum* L. (10), *Trifolium multistriatum* Koch (5), *Medicago lupulina* L. (90), *Melilotus* sp. (170), *Coronilla varia* L. (65), *Malva silvestris* Fries (5) *Malva neglecta* Wallr. (5), *Hibiscus Trionum* L. (5), *Daucus Carota* L. (387), *Convolvulus arvensis* L. (135), *Cuscuta* sp. (5), *Lithospermum arvense* L. (5), *Stachys annuus* L. (10), *Sideritis montana* L. (15), *Ballota nigra* L. (5), *Galium Aparine* L. (5), *Galium caudatum* Boiss. (5), *Cichorium Intybus* L. (55), *Cirsium arvense* (L.) Scop. (65), *Picris echioides* L. (= *Helminthia echioides* Gaertn). (5).

In other mixtures were found: Earth, small stones, hulls, broken grains, parts of insects.

List V.

Red clover from north central and eastern United States of America.

Examined by the Seed Laboratory U. S. Department of Agriculture Washington D. C.

	Number of samples	Maximum average per 1000 gm.	Minimum average per 1000 gm.
Very frequent species:			
Phleum pratense L.	122	161 040	120
Setaria viridis L. (*Chaetochloa viridis* (L.) Scribn.)	112	96 480	440
Trifolium hybridum L.	112	61 680	40
Plantago Rugelli Decaisne	112	225 760	200
Frequent species:			
Plantago lanceolata	94	230 320	1 080
Polygonum Persicaria L.	93	10 000	40
Setaria glauca (L.) P. B. (= *Chaetochloa lutescens* (Weigel) Stuntz)	90	4 080	4
Rumex crispus L.	90	7 280	80
Trifolium repens L.	90	17 360	200
Ambrosia artemisiaefolia L. (= *Ambrosia elatior* L.).	83	25 120	10
Amarantus sp.	72	2 240	5
Chenopodium album L.	73	74 240	8
Andropogon Ischaemon L. (= *Syntherisma Ischaemon* (Schrad.) Nash.)	71	30 320	4

	Number of samples	Maximum average per 1000 gm	Minimum average per 1000 gm
Less frequent species:			
Daucus Carota L.	60	32 080	40
Euphorbia Preslii Guss.	57	25 120	8
Melilotus sp.	49	36 400	40
Digitaria sanguinalis (L.) Scop. sp. (= *Synthe-risma sanguinalis* (L.) Dulac.	46	9 200	10
Panicum Crus-galli L. = *Echinochloa Crus galli* (L.) Beauv.)	46	920	120
Physalis sp.	45	11 920	80
Acalypha virginica L.	41	2 160	7
Panicum capillare L.	41	23 600	4
Medicago sativa L.	38	16 400	20
Polygonum aviculare L.	34	880	4
Rumex obtusifolius L.	34	1 160	13
Isolated species:			
Melandrium noctiflorum (L.) Fr. (= *Silene noc-tiflora* L.)	31	400	6
Rumex acetosella L.	30	2 560	4
Brunella vulgaris L.	28	720	13
Polygonum Convolvulus L.	27	320	20
Potentilla norvegica var. *hirsuta* Torey et Grey (= *Potentilla monspeliensis* L.)	27	2 960	13
Lactuca Scariola L.	26	560	7
Panicum dichotomiflorum Michx.	24	3 760	20
Polygonum Hydropiper L.	22	320	13
Cuscuta arvensis Beyrich.	22	87 200	40
Lepidium campestre (L.) R. Br.	21	1 280	5
Medicago lupulina L.	21	880	10
Malva rotundifolia L.	21	320	5
Nepeta Cataria L.	21	80	5
Hedeoma pulegioides (L) Pers.	21	13 280	10
Poa compressa L.	20	1 040	6
Plantago major L.	19	33 280	40
Lepidium virginicum L.	18	5 360	8
Agrostis alba L. (= *Agrostis palustris* Huds.)	17	320	7
Lepidium apetalum Willd. (1)	17	3 520	6
Verbena urticifolia L.	17	3 020	13
Rumex sp. (decort.)	16	230	4

(1) *Lepidium apetalum* Willd. is, in HEGI "*Illustr. Flora von Mitteleuropa*" Bd. IV, 1, a Central and East Asiatic plant. The North American plant is *Lepidium apetalum* Aschers. ex p. et auct. Germ. et Amer. = *L. densiflorum* Schrader.

	Number of samples	Maximum average per 1000 gm.	Mininum average per 1000 gm.
Rare species:			
Melandrium album (Mill) Garcke (= *Lychnis alba* Mill.)	16	560	40
Plantago aristata Michx	16	5 120	4
Panicum Gattingeri Nash	15	8 080	10
Oxalis stricta L.	15	3 760	7
Cirsium arvense (L.) Scop.	15	120	80
Chenopodium sp. (pitted)	14	880	7
Anthemis Cotula L.	14	560	7
Poa pratensis L.	13	1 680	7
Sporobolus clandestinus (Spreng.) Hitchc	13	1 560	4
Oenothera biennis L. (*Onagra biennis* L.)	13	800	20
Sida spinosa L.	13	760	6
Panicum barbipulvinatum Nash	12	6 240	40
Solanum carolinense L.	9	200	40
Triticum vulgare L. (= *Triticum aestivum* L.)	8	240	4
Sinasis arvensis L. (= *Brassica arvensis* L.) Kuntze	8	120	6
Cerastium glomeratum Thuill. (= *Cerastium vulgatum* L.)	8	240	13
Verbena angustifolia (L) Michx.	8	440	13
Cichorium Intibus L.	8	40	4
Sporobolus neglectus Nash.	7	120	40
Verbascum sp.	7	14 000	40
Cirsium lanceolatum (L.) Hill	7	40	13
Paspalum setaceum Michx.	6	360	10
Atriplex hastatum L.	6	120	7
Chenopodium sp. (poor spec.)	6	320	40
Brassica sp.	6	40	10
Euphorbia maculata L.	6	40	6
Chrysanthemum Leucanthemum L.	6	240	40
Panicum sp. (small, *Gattingeri*)	5	120	20
Poa sp. (decort.)	5	320	8
Bromus secalinus L.	5	40	13
Lolium sp.	5	80	6
Avena sativa L.	5	20	13
Polygonum lapathifolium L.	5	80	40
Trichostema dichotomum L.	5	2 080	40
Carex sp. (*Cephalophora* type)	5	160	8
Anagallis arvensis L.	5	40	13
Eleusine indica L. Gaertn.	4	120	8
Eragrostis sp.	4	520	40

	Number of samples	Maximum average per 1000 gm.	Minimum average per 1000 gm.
Rare species:			
Setaria italica (L.) P. B. (= *Chaetochloa italica* (L.) Scribn.	4	40	—
Dactylis glomerata L.	4	40	—
Poa nemoralis L.	4	40	—
Silene dichotoma Ehrh	4	40	4
Silene vulgaris (Moench) Garcke (= *Silene latifolia* (Mill) Britten and Rendle)	4	200	40
Barbaraea praecox R. Br. (= *Campe verna* (Mill.) Heller)	4	120	80
Erysimum cheiranthoides L. (= *Cheirinia cheiranthoides* (L) Link)	4	280	80
Sisymbrium officinale (L.) Scop. (= *Erysimum officinale* L.)	4	480	13
Rubus sp.	4	20	4
Dipsacus silvester Huds.	4	80	—
Verbena hastata L.	4	200	4

Found in 3 samples:

Panicum lanuginosum Ell. (120-7), *Panicum* sp. (decortic.) (720-200), *Heleocharis ovata* R. Br. (= *Eleocharis obtusa*) (40-13), *Cyperus* sp. (840-40), *Chenopodium leptophyllum* Nutt. (240-8), *Polygonum* sp. (*decort.*) (120-13), *Capsella Bursa pastoris* (L.) Med. (= *Bursa Bursa pastoris* (L.) Britton (80-7), *Trifolium* sp. (small, like *Trifolium arvense*) (280), *Geum* sp. (40), *Dracocephalum parviflorum* Nutt. (40), *Teucrium canadense* L. (40-20), *Aster* sp. (40), *Anthemis arvensis* L. (320-6).

Found in 2 samples:

Agrostis sp. (decortic.) (20-10), *Danthonia spicata* (L.) Beauv. (7-6), *Sporobolus cryptandrus* (Torr.) Gray (40-8), *Amarantus blitoides* S. Wats. (10), *Polygonum* sp. (like one in Argentine alfalfa) (40-8), *Salsola pestifer* A. Nels. (40-5), *Potentilla* sp. (40-5), *Trifolium dubium* Sibth. (13-6), *Trifolium procumbens* L. (7), *Melilotus albus* L. (400), *Linum usitatissimum* L. (80-40), *Cuphea petiolata* Koehne (13-4), *Oenothera heterophylla* Spach. (= *Raimannia laciniata* Rose) (40-20).

Found in 1 sample:

Leersia sp. (7), *Cynodon Dactylon* (L.), Pers. (= *Capriola Dactylon* (L.), Kuntz) (80), *Cenchrus tribuloides* L. (40), *Deschampsia caespitosa* (L.) P. B. (= *Aira caespitosa* L.) (40), *Arrhenatherum elatius* (L.) Mert. et Koch. (6), *Bromus tectorum* L. (4) *Bromus* sp. (decort.) (5), *Festuca arundinacea* Vill.

(13), *Festuca pratensis* Huds. (= *Festuca elatior* L.) (13), *Vulpia Myurus* Gmel. (= *Festuca Myurus* L.) (40), *Lolium multiflorum* Lam. (10), *Secale cereale* L. (20), *Hordeum vulgare* L. (40), *Hordeum* sp. (20), *Carex* sp. (3 angular concave faces) (80), *Carex* spec. (3 angled faces not concave) (13), *Heleocharis palustris* (L) R. Br. (= *Eleocharis palustris* (L.) R. et S.) (40), *Rumex salicifolius* Weinm. (80), *Polygonum pennsylvanicum* L. (10), *Mollugo verticillata* L. (40), *Stellaria media* (O.) Vill. (= *Alsine media* L.) (6), *Dianthus Armeria* L. (200), *Spergula arvensis* L. (40), *Ranunculus repens* L. (4), *Thalaspi arvense* L. (13), *Brassica juncea* (L.) Coss. (80), *Brassica nigra* (L.) Koch (760), *Camelina microcarpa* Andr. (20), *Sisymbrium altissimum* L. (= *Norta altissima* (L), Britton) (80), *Rosa* sp. (13), *Trifolium incarnatum* L. (4), *Melilotus officinalis* L. (5), *Linum virginianum* L. (360), *Hibiscus Trionum* L. (7), *Lythrum hyssopifolia* L. (13), *Lithospermum arvense* L. (5), *Lappula echinata* Gilib. (7), *Echium vulgare* L. (120), *Lycopus virginicus* L. (120), *Solanum nigrum* L. (80), *Veronica peregrina* L. (7), *Lobelia inflata* L. (40), *Cephalaria* sp. (4), *Rudbeckia hirta* L. (40), *Helianthus annuus* L. (5), *Erigeron* sp. (230), *Artemisia* sp. (5), *Senecio* sp. (4), *Chrysanthemum* sp. (20), *Sonchus asper* (L) Hill. (200), *Taraxacum corniculatum* D. C. (= *Leontodon levigatum* Willd.) (4), *Taraxacum officinale* Web. (= *Leontodon Taraxacum* L.) (10), *Hieracium* sp. (4).

Memorandum in regard to examination of Red Clover Samples in accord with the plan proposed by R. VOLKART. *Seed Laboratory, U. S. Department of Agriculture, Washington, D. C.*

The table herewith submitted is a list of the foreign seeds occurring in one hundred and thirty three samples of red clover seed grown in the north central and eastern United States. The examination of these samples and the tabulation made, represents what has been done so far in the effort to carry out the plan for an exhaustive study of the foreign seed content of certain agricultural seeds produced in the different countries, with the purpose of determining the diagnostic value of the incidental seeds occurring in forage crop seed in determining the country of origin.

Past experience has shown that red clover seed grown in North America can be determined as coming from three distinct regions. The largest and most important region extends from the north central States of North Dakota and Minnesota, southward to Missouri and Kentucky, eastward to Ontario, Canada, New York, Pennsylvania, Maryland and Virginia. The other two regions are in the north-western States, one west of the Cascades in Oregon, the other in Idaho and central and eastern Washington.

The seed from this first mentioned region was represented in this investigation by one hundred and thirty three samples. These samples were from fourteen States and the number from each State was as follows: North Dakota 3, Minnesota 5, Michigan 12, Wisconsin 14, Illinois 10, Iowa 9, Missouri 5, Indiana 13, Ohio 34, Kentucky 3, Pennsylvania 1, Maryland 6, Virginia 15, New York 3. With the exception of six samples, all were over 250 grams in weight. The samples were not cleaned but examined just as they were submitted. Some were quite weedy and others very clean.

The method of examining samples was as follows. As most samples were about a pound in weight, the samples were put through the sampling machine and a sample of 250 grams was taken. This 250 grams was divided into 10 equal parts of approximately 25 grams each. The first 25 grams was divided into two parts and the first part examined weighed exactly 12.5 grams. From the first 12.5 grams all incidental seeds were removed and counted. All incidental seeds found in the second 12.5 grams were removed and counted with the exception of those seeds which numbered more than 25 in the first 12.5 grams. The number of each kind of incidental seeds in 1000 grams was estimated from the number in the first 12.5 grams if they numbered more than 25 in that quantity, or if less, the estimate was made from the number of seeds found in 25 grams. The other portions of 25 grams each were examined for additional kinds of incidental seeds. Of the kinds of seeds not found in the first 25 grams no count was made, but a record was made of the portions examined before the seed was found. For example, if a new kind of seed was found in the fourth portion examined, the record was made that one seed was found in 100 grams. This would be equivalent to ten seeds in 1000 grams. This method differs from the method proposed by Dr. VOLKART. The method of Dr. VOLKART requires the removal and counting of all seeds from the entire 250 grams until 50 seeds of each kind was found.

The examination of these samples afforded an opportunity to determine the possibility of identifying the seed from the different parts of this large region. A study of the tabulation shows that most of the incidental seeds occurring in seed from the north central and eastern United States are seeds of plants with a very wide distribution. The tabulation, of course, records certain seeds not appearing in seed from all sections of this region, but usually the seeds are of infrequent occurrence or the seed from the region was represented

by only a few samples. Two exceptions might be mentioned. The seeds of *Cirsium arvense* are rarely found in seed grown in the southern half of this region and the seeds of *Panicum barbipulvinatum* are only found in the western part. A relief map of this region shows the mountains of the Appalachian system rising in New York and extending in a south-westerly direction through the States of Pennsylvania, Maryland, West Virginia, Virginia, Kentucky, North

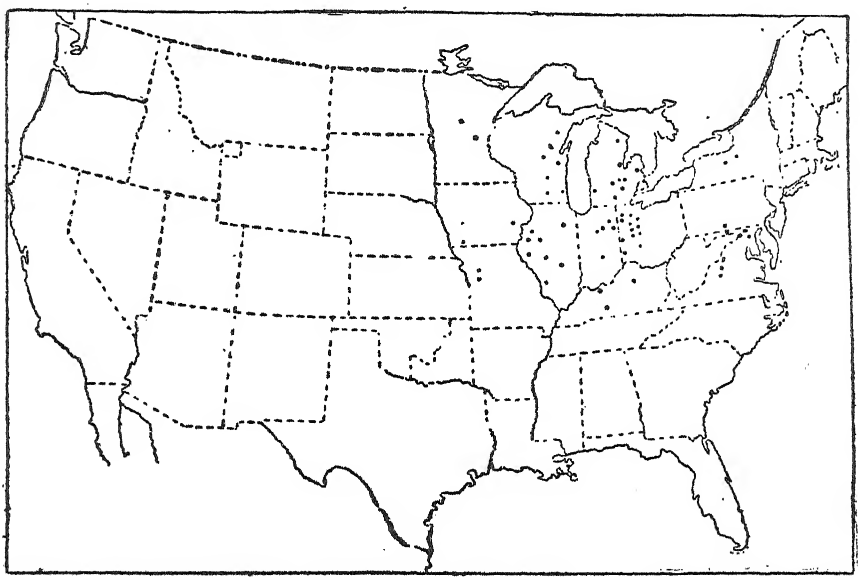


FIG. 288. — Map showing source of samples examined.

Carolina and Tennessee. The flora as exhibited by the weed seed content of red clover seed from the region east of these mountains seems to be the same as that exhibited by the seed from west of these mountains. The seeds of *Trichostema dichotomum* were found in four samples out of fifteen from Virginia, and one sample out of six from Maryland, the seeds of an unknown *Panicum* occurred in the same number of samples from the same locality, and the seeds of an unknown *Trifolium* occurred in three out of fifteen samples from Virginia. These seeds were not found in seed from any other State but the infrequency of their occurrence makes them of little value as diagnostic seeds.

The examination of a large number of samples may show more

definitely the comparative frequency of occurrence of the incidental seeds occurring in seed from different parts of this region, but the information so far shows the great similarity of the foreign seed content of seed from all parts of this large region.

Inert Matter :

In examining the samples a representative part of the inert matter was removed and filed for future study. A glance at the vials shows that the Virginia and Maryland samples contain pieces of clay, quartz and stone that differ considerably from the material removed from the western samples. So far no actual study of the inert matter has been made, but it is planned to report on this in the near future.

Colour and Weight :

It is planned also to study the colour of the different samples and weight per 1000 grains as suggested by Dr. VOLKART.

LIST VI.

Red clover from Canada (Ontario).

Examined by Dr. F. WAHLEN, Chief Analyst in charge of the Seed Laboratory, Ottawa.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species :			
Plantago Rugelii Done	10	8 000	1 500
Phleum pratense L.	9	1 224	292
Rumex crispus L.	9	260	74
Trifolium hybridum L.	9	11 320	3 415
Chenopodium album L.	8	908	166
Lepidium campestre (L) R. Br.	8	132	37
Medicago lupulina L.	8	2 720	586
Plantago lanceolata L.	8	332	164
Frequent species :			
Trifolium repens L.	7	1 740	438
Melilotus albus Desr.	7	1 200	388
Setaria glauca (L) P. B.	6	192	55
Polygonum Persicaria L.	6	116	42

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Frequent species:			
Brunella vulgaris L.	6	20	10
Plantago major L.	6	304	78
Less frequent species:			
Setaria viridis (L) P. B.	5	1 780	439
Poa pratensis L.	5	48	16
Rumex acetosella L.	5	20	11
Ambrosia artemisiaefolia L.	5	444	104
Medicago sativa L.	4	1 500	396
Anthemis Cotula L.	4	720	205
Melandrium noctiflorum (L.) Fr (*Silene noctiflora* L.)	3	36	18
Cirsium arvense (L.) Scop.	3	16	9
Isolated species:			
Panicum Crus galli L. (= *Echinochloa Crus galli* (L.) Beauv.)	2	24	14
Bromus secalinus L.	2	20	14
Sisyrinchium sp.	2	20	12
Polygonum Convolvulus L.	2	12	8
Polygonum Hydropiper L.	2	228	147
Atriplex patulum L.	2	24	20
Nepeta Cataria L.	2	4	8

Found in 1 sample:

Setaria italica (L) P. B. (4), *Digitaria sanguinalis* (L.), Scop. (4), *Decodon verticillatum* (L) Ell. (4), *Poa compressa* L. (28), *Poa compressa* L. ? (68), *Poa pratensis* L. ? (56), *Graminaceae indeterm.* (3), *Carex* sp. typ. *C. Michauxiana* (4), *Heleocharis ovata* (Roth) R. Br. (= *Eleocharis ovata* R. Br.) (4), *Rumex* sp. *decortic.* (8), *Polygonum aviculare* L. (4), *Polygonum Hydropiper* L. (not typical, probably a variety) (20), *Silene antirrhina* L. (4), *Silene inflata* Sm. (*S. latifolia* Britton et Rendle) (12), *Melandrium album* (Mill.) Garche (= *Lychnis alba* Mill.) (4), *Stellaria media* (L.), Vill. (4), *Cerastium glomeratum* Thuill. (= *C. vulgatum* L.) (4), *Camelina* sp. (40), *Erysimum cheiranthoides* L (16), *Cirsium lanceolatum* (L.) Hill. (8), *Lactuca* sp. ind. (very nearly like *scariola*) (68), *Cichorium Intybus* L. (16).

The following substances were also found :

Mineral and vegetable matter, insects, parts and excrements of insects.

Weight per thousand gm.: Maximum weight 1.5342 gm. Minimum weight 1.3599 gm.

Average weight 1.4570 gm.

The following is the average percentage colour with the corresponding weight per thousand gm :

	Violet	Prevailing violet	Violet and yellow mixed	Yellow Prevailing	Yellow	Brown
Maximum.	22	271	445	356	290	93
Weight per 1000 gm.	1.7375 gm.	1.6578 gm.	1.5615 gm.	1.5236 gm.	1.4314 gm.	1.2857 gm.
Minimum.	7	117	173	212	169	14
Weight per 1000 gm.	1.2583 gm.	1.4288 gm.	1.419 gm.	1.0621 gm.	1.2928 gm.	0.8854 gm.
Average	12,7	208.2	243.6	275.8	217.6	42.1
Weight per 1000 gm.	1.4275 gm.	1.5409 gm.	1.5086 gm.	1.4024 gm.	1.3654 gm.	1.1389 gm.

This result concerns the samples submitted in Ontario 1923 from the oldest and most important red clover producing region of Canada. In Quebec a new district is being opened up for which the necessary researches have been undertaken.

The examination was made with 10 samples of 250 gm. and was calculated to 1000 gm.

LIST VII.

Red clover from Poland.

Sent by Director W. WEIGERT, examined by Director DORPH-PETERSEN, Copenhagen.

The data of the research were based on 2 samples of 175 and 150 gm. and was calculated to 1000 gm.

On the average were found :

Rumex crispus L. and *R. obtusifolius* L. (108), *Polygonum aviculare* L. (21), *Chenopodium album* L. (73), *Sinapis arvensis* L. (27), *Medicago lupulina* L. (9), *Trifolium repens* L. (63), *Lotus corniculatus* L. (6), *Anthyllis Vulneraria* L. (26), *Melilotus* sp. (88), *Ornithopus sativus* Brot. (21), *Convolvulus arvensis* L. (6), *Plantago lanceolata* L. (6440), *Anthemis arvensis* L. (26), *Centaurea Cyanus* L. (6), *Cichorium Intybus* L. (42).

Found in 1 sample :

Avena sativa L. (6), *Carex* sp. *Polygonum Convolvulus* L. (6), *Polygonum tomentosum* Schrank and *P. Persicaria* L. (20), *Silene inflata* Smith (6), *Silene dichotoma* Ehrh. (6), *Scleranthus annuus* L. (6), *Ranunculus* sp. (7), *Vicia hirsuta* (L.), S. F. Gray (7), *Echium vulgare* L. (17), *Lithospermum arvense* L (7), *Veronica hederifolia* L. (6), *Galium caudatum* Boiss. (6), *Centaurea Jacea* L. (7), *Cirsium lanceolatum* (L.) Hill. (6).

In addition were found :

Earth, red earth, pebbles, hulls, broken grains, parts of insects.

List VIII.

Red clover from Czecho-Slovakia.

Sent by Director E. Vitek, Prague; examined by Director Dorph-Petersen, Copenhagen.

The examination was made with 3 samples of 100, 150 and 150 gm. and was calculated to 1000 gm.

On an average were found:

In 3 samples: *Trifolium repens* L. (180), *Plantago lanceolata* L. (11600).

In 2 samples: *Rumex crispus* L. (11), *Trifolium hybridum* L. (8), *Geranium pusillum* L. (28), *Daucus Carota* L. (166).

In 1 sample: *Lolium perenne* L. (13), *Rumex Acetosella* L. (60), *Polygonum aviculare* L. (7), *Chenopodium album* L. (424), *Silene inflata* Smith. (7), *Silene dichotoma* Ehrh. (270), *Papaver dubium* L. (20), *Sinapsis arvensis* L. (67), *Rubus* sp. (7), *Medicago lupulina* L. (10), *Medicago sativa* L. (1720), *Anthyllis Vulneraria* L. (20), *Conium maculatum* L. (27), *Cuscuta trifolii* Bab. (60), *Galium caudatum* Boiss. (7), *Anthemis arvensis* (7), *Chrysanthemum inodorum* L. (*Matricaria inodora* L.) (7), *Cirsium arvense* (L.) Scop. (13), *Typhula trifoli* Bab. (13).

In other mixtures were found:

Earth, red earth, pebbles, black pebbles, hulls, fragments, parts of insects.

List IX.

Red clover from Roumania.

Sent by Director J. Enescu, Bucharest.
Examined by Director Dorph-Petersen, Copenhagen.

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species:			
Setaria panicea. Schinz et Thell. a. *viridis* (L.) P.B.	5	4 560	1 447
Chenopodium album L.	5	40 160	9 859
Polygonum aviculare L.	5	630	174
Trifolium repens L.	5	260	121
Daucus Carota L.	5	8 440	3 374
Plantago lanceolata L.	5	11 680	4 432
Cichorium Intybus L.	5	3 240	1 692
Cirsium arvense (L.) Scop.	5	109	21
Rumex crispus L.	4	200	72
Medicago sativa L.	4	3 080	1 408

	Number of samples	Maximum per 1000 gm.	Average per 1000 gm.
Very frequent species:			
Medicago lupulina L.	4	189	130
Lotus corniculatus L.	4	171	81
Anagallis arvensis L.	4	360	180
Veronica Tournefortii Gmel	4	103	61
Brunella vulgaris L.	4	229	93
Valerianella dentata Poll.	4	17	14
Frequent species :			
Digitaria sp.	3	80	42
Lolium sp.	3	23	13
Silene inflata Smith	3	103	70
Delphinium sp.	3	29	14
Thalaspi arvense L.	3	74	51
Sinapis arvensis L.	3	143	91
Trifolium hybridum L.	3	333	126
Melilotus sp.	3	1 020	547
Galium caudatum Boiss.	3	11	7
Stachys annuus L.	3	177	93
Galeopsis dubia Leers. or *G. Ladanum* L.	3	17	15
Anthemis arvensis L.	3	251	108
Lapsana communis L.	3	6	6
Less frequent species :			
Dactylis glomerata L.	2	6	6
Panicum Crus-galli L.	2	46	28
Polygonum tomentosum Schr.	2	40	23
Rumex Acetosella L	2	46	28
Atriplex patulum L.	2	590	440
Nigella arvensis L.	2	17	14
Ranunculus repens L.	2	6	6
Lychnis sp.	2	17	11
Scleranthus annuus L.	2	40	23
Malva silvestris L.	2	11	8
Viola tricolor L.	2	34	25
Pimpinella sp.	2	11	8
Chaerophyllum temulum L.	2	11	8
Cuscuta trifolii Bab.	2	680	368
Cuscuta sp.	2	6 320	3 410
Chrysanthemum inodorum L. (*Matricaria inodora* L.)	2	23	14
Picris hieracioides L.	2	6	6
Cirsium lanceolatum (L) Hill	2	17	11
Centaurea Jacea L.	2	46	26
Sonchus asper L.	2	40	25

Found in 1 sample:

Avena sativa L. (11), *Triticum vulgare* Vill. (6), *Cynodon Dactylon* (L.) Pers. (11), *Cynosurus cristatus* L. (6), *Agrostis alba* L. (6), *Bromus arvensis* L. (6), *Carex* sp. (6), *Atriplex hastatum* L. (297), *Polygonum Persicaria* L. (6), *Polygonum Convolvulus* L. (6), *Stellaria media* Vill. (6), *Spergula arvensis* L. (6), *Barbaraea* sp. (17), *Camelina* sp. (6), *Rubus* sp. (6), *Vicia hirsuta* (L.) S. F. Gray (6), *Trifolium procumbens* L. (6), *Trifolium arvense* L. (6), *Coronilla varia* L. (149), *Coronilla scorpioides* L. (6), *Genista tinctoria* L. (6), *Reseda luteola* L. (6), *Geranium dissectum* L. (11), *Erodium cicutarium* (L.) L'Her. (6), *Euphorbia exigua* L. (17), *Lythrum Hyssopifolia* L. (309), *Aethusa Cynapium* L. (34), *Torillis nodosa* Gaertn. (6), *Convolvulus arvensis* L. (40), *Echium vulgare* L. (103), *Myosotis arvensis* (L.) Hill. (6), *Verbena littoralis* H. B. et K. (23), *Salvia verticillata* L. (6), *Stachys paluster* L. (6), *Ajuga reptans* L. (6), *Rhinanthus apterus* (6), *Melampyrum arvense* L. (17), *Plantago major* L. (69), *Galium Aparine* L. (6) *Galium* sp. (6), *Anthemis Cotula* L. (6), *Centaurea Cyanus* L. (6), *Centaurea Scabiosa* L. (6), *Carduus acanthoides* L. (6) *Lactuca saligna* L. (40), *Leontodon autumnale* L. (6).

Found also:

Claviceps purpurea Tul. in 3 samples (average 13), *Sclerotinia Trifoliorum* Eriks, in 1 sample (average 11), *Sclerotinia* sp. in 2 samples (average 51), *Ustilago Crameri* Körn, in *Setaria* in 3 samples (average 68).

In other mixtures were found:

Earth, pebbles, hulls, broken grain.

The data of the research are based on 5 samples of 175 gm. and calculated to 1000 gm.

List X.

Red clover from Italy

Sent by Director F. Todaro, Bologna.

Examined by Director Dorph-Petersen, Copenhagen.

2 samples of 150 and 200 gm.; result calculated to 1000 gm.

Found on average:

Setaria viridis P. B. (28), *Setaria panicea* Schinz et Thell. (110), *Phalaris paradoxa* L. or *Ph. viridis* (= *Setaria viridis* P. B.) (16), *Rumex crispus* L. or *R. obtusifolius* L. (166), *Medicago sativa* L. (8200), *Medicago lupulina* L. (122), *Lotus corniculatus* L. (65), *Melilotus* sp. (40), *Geranium dissectum* L. (8), *Convolvulus arvensis* L. (6), *Brunella vulgaris* L. (266), *Plantago lanceolata* L. (8040), *Sherardia arvensis* L. (21), *Picris echioides* L. (= *Helminthia echioides* Gärtn.) (373), *Cichorium Intybus* L. (16).

Found in 1 sample:

Lolium perenne L. (7), *Lolium* sp. (326), *Setaria glauca* P. B. (7), *Setaria panicea* Schinz et Thell. a. *Setaria viridis* P. B. (113), *Polygonum aviculare*

L. (20), *Trifolium hybridum* L. (5), *Galega officinalis* L. (35), *Hedysarum coronarium* L. (180), *Coronilla scorpioides* L. (Koch) (7), *Malva neglecta* Wallr. (7), *Malva silvestris* L. (*mauritiana* L.) (5), *Daucus Carota* L. (30), *Stachys circinata* L'Herit. (10), *Galium Mollugo* L. (7), *Valerianella dentata* Poll. (5). *Claviceps purpurea* Tull. (5) was also found.

In other mixtures were found : Earth, small stones, hulls, broken grain.

List XI.

Red clover from France.

Sent by Professor L. Bussard, Paris.
Examined by Director Dorph-Petersen, Copenhagen.

Brittany, Dép. des Côtes du Nord.

The result is given frqm 1 sample of 175 gm. and calculated to 1000 gm.

Medicago sativa L. (800), *Plantago lanceolata* L. (667), *Medicago lupulina* L. (194), *Anthyllis Vulneraria* L. (149), *Daucus Carota* L. (74), *Echium vulgare*, L. (74), *Silene inflata* Smith (63), *Sherardia arvensis* L. (57), *Vicia hirsuta* S. F. Gray (34), *Trifolium incarnatum* L. (34), *Lolium* sp. (cleaned) (23), *Polygonum Convolvulus* L. (23), *Pimpinella magna* L. a. *P. saxifraga* L. (11), *Polygonum aviculare* L. (23), *Cichorium Intybus* L. (23), *Rumex crispus* L. (17), *Sinasis arvensis* L. (17), *Raphanus Raphanistrum* L. (6), *Malva silvestris* Fries (6), *Onobrychis viciifolia* Scop. (6), *Claviceps purpurea* Tull. (6). Earth, pebbles, hull, broken grain.

South-East, Dép. du Tarn.

A sample of 175 gm. was examined and the result calculated to 1000 gm.

Medicago sativa L. (2440), *Plantago lanceolata* L. (1800), *Daucus Carota* L. (206) *Rumex crispus* L. a *R. obtusifolius* L. (46), *Cichorium Intybus* L. (23), *Lotus corniculatus* L. (17), *Lolium* sp. (partly cleaned) (11), *Atriplex patulum* L. (11), *Malva silvestris* Fries (11), *Sherardia arvensis* L. (11), *Silene inflata* Smith (6), *Geranium dissectum* L. (6), *Medicago lupulina* L. (6), *Coronilla scorpioides* L. (6), *Brunella vulgaris* L. (6), *Teucrium Botrys* L. (6), *Picris hieracioides* L. (6).

Earth pebbles, hulls, broken seeds.

Central France.

The result of the examination is based on a sample of 175 gm., and calculated to 1000 gm.

Medicago lupulina L. (333), *Medicago sativa* L. (240), *Plantago lanceolata* L. (194), *Anthyllis Vulneraria* L. (177), *Sinapis arvensis* L. (80), *Brassica campestris* L. (46), *Melilotus* sp. (46), *Rumex crispus* L. (29), *Vicia hirsuta* S. F. Gray (11), *Echium vulgare* L. (11), *Dactylis glomerata* L. (6), *Rumex Acetosella* L. (6), *Scleranthus annuus* L. (6), *Sanguisorba minor* Scop. (6), *Geranium dissectum*. L. (6), *Lotus corniculatus* L. (6), *Trifolium hybridum* L. (6), *Daucus Carota* L. (6), *Sherardia arvensis* L. (6), *Teucrium Botrys* L. (6), *Claviceps purpurea* Tull. (6).

Earth, pebbles, hull, broken seeds, parts of insects.

Province, Dép. des Bouches-du-Rhône.

The examination was made on 1 sample of 200 gm. and calculated to 1000 gm. *Medicago sativa* L. (1320), *Picris echioides* L. (= *Helminthia echioides* Gärtn.) (195), *Plantago lanceolata* L. (85), *Malva silvestris* (Fries (60), *Anagallis arvensis* L. (50), *Setaria panicea* Schinz et Thell. or *viridis* P. B. (10), *Rumex crispus* L. (10), *Polygonum tomentosum* Schrank (10), *Kickxia Elatine* (L.) Dum. (= *Linaria Elatine* Mill.) (5), *Trifolium repens* L. (10), Earth pebbles, hull, broken grain, parts of insects.

Dr. G. GENTNER,
Institute of Plant Cultivation and Protection,
Munich.

THE PLACE OF ORIGIN OF SEEDS.

INTRODUCTION.

In the grain trade it is often necessary to study the place of origin of the materials on which transactions will depend, the seeds of the same species of plant having frequently very different values, according to their origin, or the conditions which have prevailed on their formation and at their harvesting.

A very small number of characteristics drawn from the seeds themselves — form, colour, weight, etc... — can, up to a certain point, give sufficiently exact indications, but, as a rule, if a few typical samples be put on one side, collected from well defined yet fairly restricted regions, the indications drawn from the physical characteristics of the grains are not sufficiently definite to deduce from them sufficiently accurate conclusions, even from the commercial point of view. Recourse must therefore be had to an indirect method, consisting solely in the research and examination of the natural impurities, mixed in an almost constant manner with the samples supplied by commerce.

I.

WHAT IS UNDERSTOOD UNDER THE TERM OF IMPURITIES IN THE CLASSIFICATION OF THESE SEEDS.

This term, looked at in its largest acceptation, includes all the mineral and organic bodies which can be found mixed with the pure seeds. Take, for example, an analysis of lucerne (*Medicago sativa* L.) carried out on five grammes of seed as received in commerce. We find, probably, a proportion of 90 per cent. of pure seed, together with 10 per cent of impurities. These include: (1) Organic bodies, damaged lucerne seeds, clover seeds (*Trifolium pratense* L.), black medick (*Medicago lupulina* L.), rib-grass (*Plantago lanceolata* L.), St. Barnaby's thistle (*Centaurea solstitialis* L.), buttercups of various kinds, etc... ; (2) then come mineral

bodies, grains of sand, earth, etc... ; the whole accompanied by various small vegetable fragments.

It is very evident that all these impurities have not an equal importance. First of all, it is convenient to put on one side all those which consist of seeds of good species (seeds of a good type), mixed accidentally with those of lucerne ; thus the grains of clover and black medick must be separated from the other seeds belonging to indifferent or even injurious adventitious plants (seeds of a bad type). The analysis must therefore indicate four groups of results, whatever be the form given to its wording :

1st. = Percentage of pure seeds.

2nd. = Percentage (if the quantity of them be sufficient) of other seeds of a good type (1).

3rd. = Percentage (if the quantity of them be sufficient) of the seeds of adventitious plants (1) with special mention of those of the injurious plants.

4th. = Percentage (if any) of mineral matter, vegetable fragments, damaged seeds, etc...

Of course, these groupings are susceptible to modification ; in particular, it may become necessary to calculate the rate of a seed of good type and not confine oneself to giving solely the proportion as a whole. This practice applies equally to the seeds of adventitious plants. It is even a rule to be observed, if the quantity of such, or such a one amongst them appears important, and is absolutely essential when it is a question of harmful plants ; such are, for example, the various dodders in leguminous plants, ryegrass in cereals, etc... These operations permit of making a report (germination apart) of the value, as far as purity is concerned, of a lot of seed, and it may happen that the latter suffers in consequence a considerable depreciation, or even that it becomes the object of legal proceedings, if the foreign seeds have been obviously added with a fraudulent intention.

II.

Where it is seen that impurities may be useful.

The logical conclusion of the foregoing considerations is the following : An ideal lot of seeds intended for commerce should be entirely devoid of foreign seeds and of mineral impurities ; and

this must be, or rather this ought to be, the absolute rule, as regards the seeds of injurious plants, parasites or others; moreover, this is often the case as regards dodder. But, putting this case aside, such lots of seed are not met with in commerce, and however much care has been taken in cleaning the raw seed, there is always a certain proportion of impurities mingled with the main bulk, a proportion which the honest merchant should, and can endeavour to reduce to the minimum. Nevertheless, astonishing as it may appear, the presence of impurities is sometimes a fortunate circumstance, for certain of them constitute a striking certificate of authenticity. They often show, in no uncertain manner, the source of a lot of seed, and this is frequently of considerable importance.

III.

The importance of certain impurities.

I could not give better evidence of the very great importance of certain of these impurities than by taking some examples from amongst the most typical which I have encountered in the course of ten years of observation:

First Example: *Manitoba Wheat* (2). — The attention of agriculturists was drawn to this wheat in quite a special manner during the year 1917. As is known, this wheat has a high reputation, and was employed in relatively large quantities for sowing in the spring of the year 1916.

The form of the grain, and the aspect of its fracture, give some indications, but in a general way these characteristics, drawn from the grain itself, are quite insufficient. Very fortunately, owing to the impurities accompanying this wheat, the determination becomes very easy. The following is the list of foreign seeds which are met with in it: Field mustard (*Sinapis arvensis* L.), shepherd's purse (*Thalaspi arvense* L.), panicled neslia (*Neslia paniculata* Desv.), garlic wort (*Erysimum orientale* R. Br.), corn-flower (*Lychnis Githago* Lam.), stick-seed (*Echinospermum Lappula* Lehm.), bindweed (*Polygonum Convolvulus* L.), goose-foot (*Chenopodium album* L.), various dew-grasses (*Setaria* sp.), It is as well to add to this list the few grains of oats and barley, as well as the few flax seeds, which always accompany the preceding impurities.

The combination of all these foreign seeds is absolutely characteristic of these wheats. Three amongst them, however, are particularly interesting, namely, the seeds of *Echinospermum Lappula*, those of the *Neslia paniculata*, and the grains of *Erysimum orientale*.

Amongst the numerous samples which have come under my observation, the presence of these seeds is constant, and indicates that of all the others.

In this connection, I would point out a fact which may be interesting from the point of view of botanical geography. In the most recent floras of France there is sometimes given with great detail the geographical distribution of plant species, not only on the soil of our own country, but over the surface of the whole world; but, none of these excellent works point out the presence of *E. orientale* in North America. Under these circumstances, therefore, and without any doubt, the plant has been introduced there by cultivation since the time when these data relative to its area of extension were collected in the French floras.

Moreover, *E. orientale* has been pointed out in North America and particularly in Canada, in the floras of NATHANIEL, LORD BRITTON and ADDISON BROWN (3), who express themselves on this subject in the following manner: " In waste places, Michigan and Minnesota to the Northwest Territory, and from the Atlantic coast from New Brunswick to Pennsylvania. Has recently become a bad weed in the Northwest ".

The seeds of the plant are listed, moreover, in a collection prepared by the Canadian Department of Agriculture and sent, a few years ago, to the Station d'Essais de Semences at Paris. The same remarks and the same conclusions appear with regard to *Echinospermum Lappula* Lehm, on the subject of which the above-mentioned authors express themselves as follows: " In waste places Nova Scotia to British Columbia, south to New Jersey and Nebraska. Naturalized from Europe. Native also of Asia " (4). It is seen from this example that the study of impurities may lead, from entirely practical and utilitarian considerations, to views of a much more general nature. I will give other proofs of this in the examples which are about to follow.

SECOND EXAMPLE: *Barley and Oats*. — Here it is a question of a more complex case.

In the course of the last few years, on several occasions, the

Fodder Department of the Administration applied to the Station d'Essais de Semences at Paris to ascertain the place of origin of various lots of oats and barley. The question was important then, because at that time purchases of the cereals in question could only be made from parcels of French origin (5). From various sources, numerous samples were sent to us, which, added to those we already possessed (of authentic origin), constituted a considerable number of lots which were entrusted to me for study. The following are the conclusions reached which are given as I formulated them at the time.

Barley.

The different varieties of barley examined came respectively from the South of France, Algeria, Tunis, Serbia and Australia. To these samples was added a barley said to be from the Danube, without any more definite specification. The species or genus to which belong the various seeds found in a state of impurity, in the lots which I examined, are as follows:

1st: The South of France. — Wheat, rye, field foxtail, *Phalaris brachystachys* Link, *Rapistrum rugosum* Berg and *Rapistrum orientale* D. C., French grass, honey-lotus, *Torilis nodosa*, Gaertn, *Chrysanthemum coronarium* L.

2nd: Algeria and Tunisia. — Hard wheat, English rye-grass (*Lolium perenne* L.), *Phalaris brachystachys* Link, *Rapistrum rugosum* Berg and *Rapistrum orientale* D. C., *Bifora* sp., coriander (*Coriandrum sativum* L.), *Chrysanthemum coronarium* L., beet.

3rd: Danube. — Rye, various dew-grasses, *Rapistrum perenne*, *Saponaria vaccaria* L., hemp, bindweed (*Convolvulus arvensis* L.).

4th: Serbia. — Rye, *Saponaria Vaccaria* L.

5th: Australia. — Small grains of wheat in great quantity.

In examining these different groups of impurities, it is noticed that seeds exist which may serve to unite certain groups and exclude others. Thus, *Rapistrum* permits of the separation of the barleys of Algeria, Tunis and the South of France, from those of the Danube, Serbia and Australia. On the other hand, the seeds of Krubora make it possible to separate the barleys of Algeria and Tunis

from those of the South of France. Finally, from the few samples, unfortunately too rare and too small, of Smyrna barley which I have had in my possession, I am almost of opinion that their impurities will cause them to be classed with those of Tunis, in spite of the fact that I have not come across any Krubora seed in them, which is probably only an accident, due to the smallness of the samples.

The classification of all these barleys could therefore be effected in the following manner:

Rapistrum rugosum *Rapistrum orientale* *Phalaris brachystachys* *Chrysanthemum coronarium*	Barleys of countries round the Mediterranean	1. *Krubera leptophylla* - Algeria, Tunisia, Smyrna. 2. Absence of *Krubera* - South of France.
Rapistrum perenne *Setaria* sp. *Saponaria Vaccaria*	Barleys of the Danube	
Numerous small grains of wheat	Barleys of Australia	

Of course, it cannot be expected that absolutely accurate results will be obtained, in consequence of the extent of the area occupied by a number of adventitious species. But such as they are, their accuracy is sufficient for commercial requirements, for the groups obtained bring together the barleys found in analagous climates, and consequently having similar requirements and properties.

IMPORTED OATS.

Investigations carried out in the same manner on imported oats (6) give the following results:

Phalaris brachystachys *Rapistrum orientale* *Krubera leptophylla* *Chrysanthemum coronarium* *Bupleurum protractum*	Algeria and Tunisia

Do not contain the above impurities
- *Ambrosia artemisiaefolia.* Oats stated to be from America.
- none
  - *Rapistrum perenne* - Danube,
  - none
    - *Neslia paniculala* - Russia and Libau,
    - *Echynospermum Lappula* - Courland,
    - - Reval,
    - - Koeingsberg,
    - - Danzig.
    - None, but much rye-grass - La Plata.

LUCERNE FROM TURKESTAN.

The lucerne of Turkestan is only a variety of ordinary lucerne (*Medicago sativa* L.) adapted to the continental climate of Central Asia. Examined closely, as much from the point of view of the seed as of the vegetative part of the plant, it scarcely differs at all from ordinary lucerne; with difficulty there may be found a few vague characteristics in the seeds, but they are so delicate, that one must have been accustomed to the handling of seeds for a long time in order to be able to discover them.

This lucerne is really inferior to French lucerne. The results of experiments carried out at the Station d'Essais de Semences have been decidedly unfavourable to it. Among other disadvantages, it gives less abundant fodder than in the case of the indigenous varieties, and moreover, does not last as long as these. It is therefore of very great interest to be able to distinguish the seeds of Turkestan lucerne. Here again, it is the impurities which enable us to do this, and more especially one of them: the fruits of *Acroptilon Picris* D. C., a plant of the Compositae family, occupying a fairly extensive geographical area, including a large part of Asia Minor, the Cis- and Trans-Caucasus regions; also a part of austro-occidental Persia, as well as the north and centre of this region; and finally Turkestan and Afghanistan.

The fruits of this plant are quite characteristic, and very easy to recognize. They appear in the lots of lucerne as pearl-white achenes, a little larger than the seeds of lucerne; the faces are slightly flattened, and the contour is not symmetrical, one of the sides being more rounded than the other. The upper extremity, which is wider

than the opposite extremity, has a slight conical protuberance, whilst a shallow depression is noticeable at the opposite end.

Once these seeds have been seen, it is impossible to confuse them with other impurities, hence they are quite characteristic.

DETERMIMATION OF THE CHARACTERISTICS OF SOUTHERN SEEDS OF CLOVER AND LUCERNE.

These latter studies, as regards the researches to which they have led, are most typical, and show the great importance of botanical geography in the analysis of seeds.

In a general way — all consideration of place being put aside — if there exist at present a certain number of plants which were formerly utilized successfully, and which are now of only very limited importance, in consequence of the enormous area which they have gradually covered, there are others, however, which would not be able to resist the very diverse climatic conditions corresponding to the whole of the cultivated soil of France. The actual limits of the zones of vegetation of these plants can therefore be investigated with the certainty that, as it is not possible for these limits to vary much, the conclusions drawn from the presence of the seeds of these plants will be sound, so long as the diverse biological conditions obtaining at the distribution of these plants remain the same. For all these reasons, and still others which it is unnecessary to examine here, I have been led to make a special study of the actual northerly limits of one leguminous plant, *Coronilla scorpioides* Koch.

According to the information drawn from the most recent floras, this plant occupies a fairly extensive geographical area. M. ROUY, in his *Flore de France*, expresses himself on this subject as follows: " Habitat : Crops, and cultivated districts in the whole of the south and in the west, up to and including la Vendée, extending on the east as far as Saône-et-Loire, in the Centre as far as Cher and Indre-et-Loire. Corsica : Gulf of Boniface (Fliche). "

" Geographical area : Mediterranean region of Europe and Africa, Asia Minor, Caucasus, Persia, Syria and Palestine. "

Moreover, prior to this, LECOQ (1856) gave the following particulars relative to the limits of extension of the species : South, Cyprus, 35° — North, France, 46° — West, Portugal, 10° — East, Georgia, 46° E.

What interests us being the northern limit in France of the zone of vegetation of this plant, and its presence on fields of clover and lucerne, I have tried to obtain more exact data. The local floras have supplied me with a fair amount of information, but as since their publication, the plant might have been displaecd by crops, I have also had recourse to the assistance of botanists living in the departments situated on the northern frontiers of the zone occupied in France by *Coronilla scorpioides*, together with the study of a large number of samples of French seeds (clover and lucerne) which I have examined myself. Wherever I have applied for information, I have been met with the greatest kindness, and I am happy to express again here my sincere thanks to all those whose co-operation has enabled me to acquire a quantity of valuable information (7).

I summarise below the results obtained by adopting the following order: Starting from the extreme north-western limit of the zone of vegetation of the plant, I shall reach the East of France, to return again to my starting point, after having, as is about to be confirmed, entirely encircled the central block.

VENDÉE. — *Coronilla scorpioides* is met with solely in the southern plain. Localities where the plant is indicated: Bonet, Saint-Pierre-le-Vieux près Maillezais, Mouzoil près Nalliers, are, in a general way, nearly all situated in the region of Luçon and Fontenay-le-Comte. *Coronilla scorpioides*, moreover, is never very abundant there; the areas pointed out by LLOYD 60 years ago have not been extended. Besides, the plant is smaller and less vigorous than in the South.

DEUX-SÈVRES — LLOYD described this plant as being fairly common; BOREAU, in his Flore du Centre, mentions it at Thouar, Saint-Jouin, Airvault. The particulars I have gathered only report it at la Gâtine, where *C. scorpioides* has never been met with by my correspondent. Moreover, the seeds of the plant have not been found in the samples of clover or lucerne supplied by the farmers of the Department. It is true that the localities whence it has been sent to us are sufficiently removed from the areas indicated by BOREAU; they are, however, more southern, and situated quite at the south of the district of Parthenay, as well as in the neighbourhood of Niort and Saint-Maixent.

MAINE-ET-LOIRE. — *Coronilla scorpioides* is very rare in Anjou, and is only met with in a few calcareous areas in the district of

Saumur: Vihiers, Doué, Puy-Notre-Dame, Montreuil, Fontevrault (Boreau, 1859), where, moreover, it only appears now and then. The same remark applies with regard to the samples of clover and lucerne. Only one locality from which these seeds reached us is situated in the district of Saumur, quite in the south.

Vienne. — The various floras that I have consulted indicate that the plant is relatively common in crops and on calcareous waste land. The areas mentioned are the following: Loudun, Poitiers, Saint-Bénoît, Cissé, Auxances, Marmande, La Grand'-Maison. The seeds have not been met with in the samples of seed of the two fodder-plants with which we are dealing; nevertheless, a good number of the localities whence they come are situated in the neighbourhood of the places where *C. scorpioides* is indicated.

Charente. — The plant must be fairly common in the Department.

One of my correspondents points out that it would require searching for in the Confolontais towards Saint-Cloud and Chassensuil. On the other hand, the samples of clover coming from Vars, d'Anais, de Tusson, the Plans de Ruffec, contained some seeds of *C. scorpioides* amongst their natural impurities.

Dordogne. — The plant appears to be relatively fairly well diffused here; in any case, one of the samples of clover coming from Rouffignac, Canton of Sigoulès, district of Bergerac, included some seeds of *Coronilla scorpioides*. Desmoulins, moreover, in his catalogue of plants of the Dordogne, points out that this *Coronilla* is common in fields and cultivated places: Bout des Vergnes près Bergerac; in the crops; Ribérac, in a field above the town and on a hill called Terrier de Lambrette near Saint-Aulaye sur Dronne. (Abbé Revel, 1885).

Corrèze. — The plant seems to be rather uncommon in this Department. It has been noted in the following stations, all situated between Brive and le Lot: Croix Lagarde, Commune of Noailles, Chasteaux, valley of Entrecor, Puy-de-Crochet. We have not received any samples of clover or lucerne from this Department.

Lot. — The local floras note the plant at Rocamadour, Roque de Cor, Saint-Georges, Les Cayssines près Cahors, Montcuq, Lissac, Canton of Figeac. The very few samples supplied by this Department contained some seeds of *C. scorpioides*.

Aveyron. — A. Bras mentions vineyards and cultivated fields. The areas he indicates are the following: Arrondissement de Ro-

dez : Le Cruounet. Arrondissement de Villefranche : crops of the tableland of Ordiget, de la Bouisse, bois de la Gueste ; Salvagnac-Cajaro : crops of the tableland of Cubèle, Asprière, Naussac, Sonnac. One of the few samples of clover supplied by the farmers of this department contained some seeds of *C. scorpioides*. Other areas : Nant, Saint-Jean-du-Buel, Vabres, Saint-Izaire (ABBÉ COSTE), have been also mentioned.

CANTAL. — According to LAMOTTE and FRÈRE HERIBAUD, the areas of this plant, rare in the Cantal, are reduced to a few localities in the neighbourhood of the Departments of Lot and l'Aveyron : Monmurat, Gratacap, Saint-Santin-de-Maurs.

HÉRAULT. — The plant is noted as being very common in cultivated fields. As in the case of Cantal, no consignments of clover and lucerne have been made to us.

GARD. — DE POUSOLZ and LAMOTTE found this plant in the neighbourhood of Nîmes, at Vigan, Anduze, Alais, Saint-Ambroix.

On the other hand, one of the samples of lucerne from this Department, from Cornillon near Pont-Saint-Esprit, contained seeds of *C. scorpioides* amongst its impurities. The plant is known in this department, and has a local name.

ARDÈCHE. — The limits given by SAINT-LAGOR are the following : Le Pouzin, the valley of the Ouvèze, Celle, and near d'Aubenas, Vals and Mercuer. A sample of clover from the district of Chomérac contained some seeds of the plant. In 1897, CARIOT and SAINT-LAGOR mentioned the presence of the plant on the banks of the Rhône, in the valleys of the Ardèche, and the Ouvèze. Elsewhere, RÉVOL (1910) is more definite, and gives the following particulars : southern districts of the basins of the Ardèche up to Saint-Privat, Aubenas, Ucel, the tributaries of the Cêze, the valleys of la Conche, of the Escoutay and the Ouvèze low hills of Coiron up to 500 m. and the banks of the Rhône up to the Valley of Celles, Lavoulte, Chateaubourg.

DRÔME — SAINT-LAGOR points out that in the Drôme, *C. scorpiodes* grows near Nyons, Crest, Barnave and Valence ; other areas Saint-Nazaire (CARIOT and SAINT-LAGOR, 1897).

HAUTES-ALPES — Gap, Ribiers, Rosans are, still according to SAINT-LAGOR, the limits of locality of the area of extension of the plant in this Department. CARIOT and SAINT-LAGOR (1897) indicate still another district : Notre-Dame du Laus.

The few samples of clover and lucerne which have reached

us from Rosans, Lazer, contain numerous seeds of *C. scorpioides*.

Isère — Saint-Lager mentions here, as limits of locality: Mens, Rochefort, the Balmes de Claix, Comboire, Saint-Martin-le-Linoux, areas which, moreover, are all grouped in the district of Grenoble, to the south of this town in the basin of the Drac, with the exception of Saint-Martin-le-Linoux, which is a little to the north of Grenoble, on the right bank of the Isère.

Rhône. — In the Rhône the plant is rare. Les Carpennes, Villeurbanne (Cariot and Saint-Lager, 1897). According to my correspondent, it is never found ordinarily in clover and lucerne. In certain years, however, it has been noticed, but very likely this has been the result of an accidental introduction, due to the employment of seed coming from the south. In a general way, it rapidly tends to become rare and to disappear, except in the areas where the conditions are particularly favourable to its existence. The seeds of the plant have not been met with amongst the natural impurities of the clover and lucerne of this department.

Ain. — The plant is not mentioned in the Ain district. One of my correspondents, however, has come across it several times between Miribel and Montlöel, in fields of wheat, along a very much exposed river bank. The samples of clover from the Ain do not, up to the present, contain seeds of the plant. This Department has not supplied us with any lucerne.

Saône-et-Loire. — Found occasionally at Bourbon Lancy and at Marigny-sur-Loire. *Coronilla scorpioides* has not held its own in these districts. Besides, according to my correspondent, the plant has never been met with in the fields of lucerne and clover.

Loire. — The plant is not found in this Department; at least, the floras which I have consulted do not indicate it (Le Grand, Statistique botanique du Forez, 1873; Cariot and Saint-Lager, *Flore descriptive du bassin moyen du Rhône et de la Loire*, 1897). On the other hand, none of the numerous samples of clover examined contained seeds of this plant.

Allier. — *Coronilla scorpioides* has been previously noted at Pont de la Chambrière près Montluçon.

Nièvre. — The plant has not been noted in this Department.

Loiret. — Jullien Crosnier, according to Nouel, points out that *C. scorpioides* has been met with at Baccon. It is probably a question of an accidental appearance. In any case, the numerous samples of clover and lucerne coming from this Department have

never, up to now, had seeds of this plant amongst their impurities.

LOIR-ET-CHER. — *Coronilla scorpioides* has not been reported in this department. Moreover, the seeds do not figure amongst the impurities of the clover and lucerne which come from this region.

CHER. — *C. scorpioides* is extremely rare here. It has been pointed out formerly by BOREAU at Saint-Michel, Bourges, Etrechy (near Osmery) (A. LE GRAND : Flore du Berry), Morthomiers, la Chapelle-Saint-Ursin. A. LE GRAND, in his flora of Berry, and in the supplement to this flora, adds a few other localities. It appears that it was abundant about fifteen years ago between the Camp d'Avor and Farges-en-Septaine, and has been gathered at Bangy in a rocky field where clover and lucerne have never been sown. According to one of my correspondents, it must be remarked that, in a general way, the places where the plant has been observed are quite barren areas and noted in Berry for the numerous southern plants which are found there ; it could not be found on soils where the cultivation of seeds leys is practised. A. LE GRAND mentions it as being very rare (R.R.) in the crops. In short, the plant may exist in Berry, but only as a very rare botanical curiosity, and without any practical importance. I have never found these seeds in the samples of clover or lucerne which I have had to examine.

INDRE-ET-LOIRE. — *Coronilla scorpioides* has been reported at various points : Antogny, Ports, Marcilly, from l'Ile Bouchard to Richelieu, Chinon. All these areas are situated in the district of Chinon, and, with the exception of this locality, between the course of the Vienne and the Department of the same name.

I have now returned almost to my starting point, since I have already examined the distribution of *Coronilla scorpioides* in the Departments of la Vienne and of Maine-et-Loire. I have already described, round the central block, and following the distribution of the plant in as exact a manner as possible, a complete circle, on the inside of which it does not exist, or would have, at most, an ephemeral existence. An exception must be made, however, in favour of the Puy-de-Dôme, where there are the following areas : Saint-Amand-Tallende (frère HÉRIBAUD), Puy-de-Barnère (LAMOTTE), Saint-Saturnin, Saint-Sandoux (frère GENNARDIEN). The plant, however, is uncommon.

From the practical point of view, a few conclusions might be drawn from the preceding study. I think there is no occasion to

take into acount the northern portion of the circle, extending from the south of the Isère to la Vendée; for, generally, the plant does not exist there, except in very rare instances; also, where it is pointed out as being fairly common, it does not appear to be sufficiently so from the point of view which interests us, since up to the present I have never found its seeds in the samples of clover and lucerne which I have had to examine. It is the same for the Department of Puy-de-Dôme. An exception might perhaps be made for the Department of la Vendée. This exception, however, hardly appears to be justified, at the very least, as regards clover: none of the centres of production is situated in the zone where *C. scorpioides* can be found; the only locality of this district having responded to our appeal, namely, Chaume, commune of Sainte-Hermine, has supplied us with a sample of clover which was entirely without seeds of *C. scorpioides*. Finally, the rather stunted state of vegetation of the plant in this Department renders very uncertain the presence of its seeds amongst the natural impurities of clover and lucerne. It is also very unlikely in the Department of Indre-et-Loire to be found with these two leguminous, fodder-plants. As regards la Vienne, where the plant is common, or fairly common, I remember that none of the samples of clover and lucerne, even those coming from points bordering on the stations occupied by *Coronilla scorpioides*, had the seeds of this plant amongst their impurities.

The southern half of the circle surrounding the central block on the south, from la Charente to la Drôme, must, on the contrary, be considered, from the practical point of view, as the northern limit of the districts where clover and lucerne are almost certain to include the seeds of *Coronilla scorpioides* amongst the number of their impurities. Thus, amongst the Departments situated to the south of this zone, all those who responded to our appeal supplied samples which frequently, almost without exception, contained the seeds of this coronilla.

One result of a different nature has been evolved from the examination of the regional limits of vegetation of *Coronilla scorpioides* in France. It is very certain that the absence of the plant from the central block (the stations of Puy-de-Dôme apart) is partly due to the fact that the meteorological conditions no longer respond to the needs of this plant; but there is another cause, perhaps more important still, operating to determine in a very exact

manner the distribution limit of *Coronilla scorpioides*, a cause which stands in relation to the requirements of the plant, viz., the structure of the soil of France itself. If, after having indicated on a map as accurately as possible, the geographical position of the areas enumerated above, this map is superposed on a geological map traced

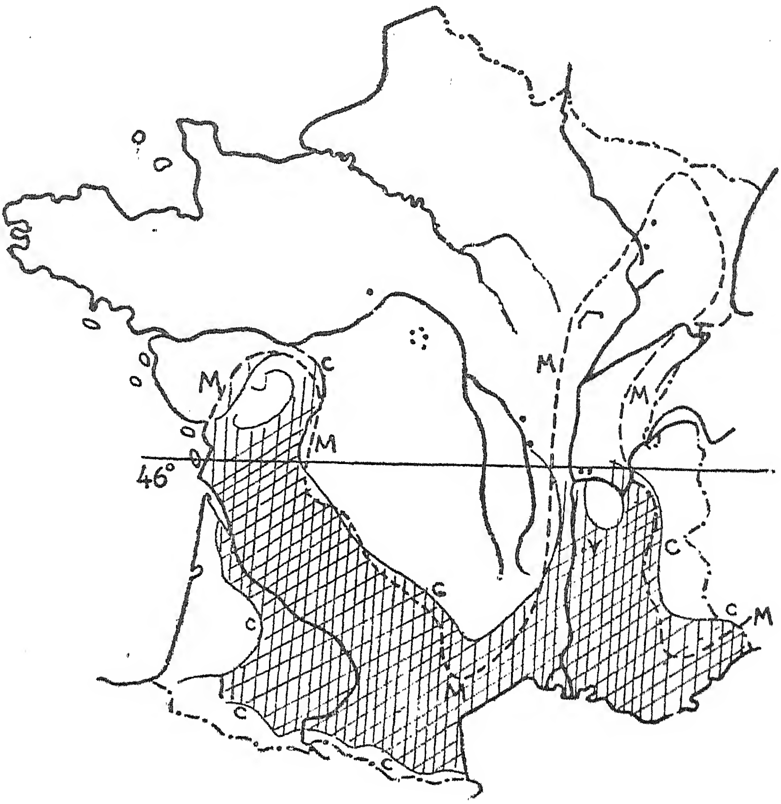


FIG. 289. — Area in France covered by *Coronilla scorpioides*: cross-hatching = common habitats of the plant.

to the same scale, it is immediately noticed that the very great majority of the localities where the plant has been noted, are placed on the fringe of the secondary strata which surround the central block. I have endeavoured to obtain more exactitude by examining the respective situation of each of the areas on detailed geological maps, and I have ascertained that it is in a great measure on the Jurassic portion of this fringet hat the greater part amongst them are placed by preference. This coincidence some-

times acquires a remarkable degree of precision. There are now the Cretaceous areas; these areas are much more rare on the outcrops of the other geological formation.

With these data, and as a practical conclusion of this work, I think that, as regards the production of clover and lucerne, we

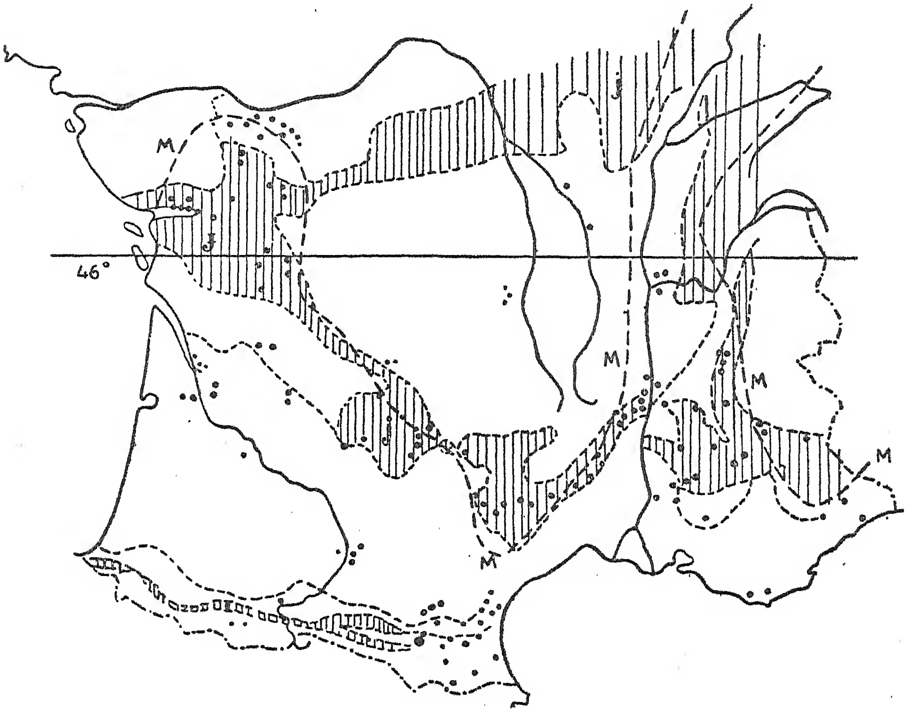


FIG. 290.

J. Jurassic.

M. Northern limit of maize growing.

Chief permanent habitats of *C. scorpioides*.

To the north of 46° and even south of that parallel for the centre and east of France, the appearance of *C. scorpioides* is always more or less transitory.

might consider as southern all the districts situated to the south of the Jurassic fringe, extending inclusively from la Charente to la Drôme, and leaving on the north of this limit le Rouergue and the Black Mountain.

I have indicated on the accompanying map the sites of the limiting areas, and their correspondence with the secondary border of the central block. Of course, on my rather small map, it is

impossible to respect strictly the intricacy of the geological deposits, and particularly their outcops on islets, often very narrow; nevertheless, it is sufficiently accurate I think, to enable one to determine very clearly the general bearing of the areas at the northern limits occupied, in France, by *Coronilla scorpioides*. I have also traced a portion of the limiting curve of the cultivation of maize, and it will be noticed that there is a certain coincidence between this portion of curve and the distribution of most of the areas mentioned above.

***

This study, undertaken with a practical object, concludes here. But I have thought that perhaps botanist readers would be interested to know, in detail, other French areas of *C. scorpioides*, and, first of all, those of the Departments situated on the other side of the Canal du Midi and the course of the Garonne.

These stations are distributed as follows: AUDE — (GAUTIERS: Flore des Corbières) Narbonne, Pech de l'Agnel, Montredon, Gruissant, district of la Chape, Sigean, Saint-Victor, tableland of Fontjoncouse, Durban, Albas, Villeneuve, Massac, Servières-en-Val, La Vène, Verzeille, Limoux, Alet, Quillan, Carcassonne, Bois de Serres, Charlemagne, Pont de l'Orbieu 500 m., Monthoumet 500 m. There again, in examining the geological map, it is seen that most of these areas are situated on calcareous lands, very frequently Jurassic, then Cretaceous.

EASTERN PYRENEES. — The local flora of G. GAUTIER gives the following districts: Charamany, Saint-Antoine de Galamus, Saint-Nazaire, Estagel, Rabouillet, Vallée de Tech, Albéres, de Céret to the Manère (973), Ria (near Prades).

ARIÈGE. — An area indicated by MUTEL: Saleix 1013 m. near Vic Dessos, is distinctly situated on a Jurassic outcrop.

HAUTE-GARONNE. — Plant common in the neighbourhood of Toulouse, everywhere on cultivated ground. PHILIPPE gives, in addition, two mountain areas: Saint-Béat 525 m.; Saint-Bertrand de Comminge 515 m., where the plant is common.

HAUTES-PYRENEES. — Common in the crops: valleys of Argelès, Barèges, Luz, are the districts mentioned by PHILIPPE, and by DULAC.

These areas enable the tracing of approximately the southern

limits of the zone occupied by *C. scorpioides* to the north of the Pyrenees. Between this limit and that which I have given previously — south and south-west border of the central block — extends the area occupied by the plant in the south-west of France.

Within these limits, *C. scorpioides* is commonly found in *Tarn-et-Garonne*, the *Lot-et-Garonne*, *Gers*, the *Dordogne* and the *Gironde*.

For this latter Department, CLAVAUD gives the following districts: Cultivated fields, crops on calcareous soil — Blaye — le Médoc (Chicou), Bourg, Cestats, Gradignan, Créon, Haux, Bayon, Le Rigalet, Poussignac in the Bazadais.

Let us now endeavour to trace the eastern limit of the area occupied by the plant in France. Here, parts of the following Departments: Alpes-Maritimes, Basses-Alpes, Hautes-Alpes, Drôme, Isère, will serve us. Most of them have already been indicated previously. I will add to them first a general note referring to the entire source of origin, and then particular indications for each Department.

PROVENCE. — The plant is found in the harvest fields, uncultivated places, all the coastal region (H. ROUX).

ALPES-MARITIMES. — Plant fairly common in stony fields (ARDOINE). Fairly common in the coastal region, and here and there in the mountainous region, where it grows up to 1,200 and 1,300 m. (BURNAT) — Antibes (THURET) — Gourdon (CONSOLAT) 760 m.

BASSES-ALPES. — Pointed out in the upper basin of the Ubaye, in the fields of the district of Barcelonnette 1,135 m. (LANNES).

These stations, joined to the localities indicated in the Hautes-Alpes, la Drôme and l'Isère, allow the tracing approximately of the eastern limit of the area of *C. scorpioides* in France.

In its southern part, this area adjoins the Ligurian coast and the neighbouring districts. On the other hand, in the basin of the Rhône, the limits running on both sides of the river, border a zone extending up to the level of Valence (and even a little more to the north on the Ardèche bank). Beyond there, *C. scorpioides* may still be met with occasionally, apparently more or less fugitive and never persists long.

The map given below shows the whole of the area occupied by the plant, and beyond which a few scattered spots indicate the localities, the points of territory, where it has been mentioned as

in a state of rarity, or as a botanical curiosity, and where, generally, it does not persist.

In order to be complete, I will indicate some localities situated in the Var, the Bouches-du-Rhône, and the Department of Vaucluse.

VAR. — Is met with in the coastal region: Toulon (HUET), Hyères (SHUTT).

BOUCHES-DU-RHÔNE. — In the fields it is sufficiently common not to merit any mention of locality.

VAUCLUSE. — Neighbourhood of the village of Vaucluse — Avignon and neighbourhood — district of Lubéron between Saignon and Cadenet — district of Carpentras, of Ventoux and the Monts de Vaucluse.

NEW INVESTIGATIONS MADE WITH A VIEW TO SPECIFYING THE CHARACTERISTICS OF CLOVER AND LUCERNE SEEDS OF THE SOUTH OF FRANCE.

This series of investigations was undertaken to ascertain whether the characteristics which we have made the basis for indicating the southern origin of clover and lucerne, were always valid, and also, if there be occasion, to add new characteristics to those which have been employed hitherto.

The certitude of the southern origin of a parcel of seeds of clover and lucerne is assured, at present, by the presence, in the lot to be examined, of seeds of the following adventitious plants: *Helminthia echioides, Centaurea solstitialis*, small *Rubus* achenes, *Torilis nodosa, Coronilla scorpioides*, to which must be added, but solely as a complementary characteristic, shell fragments, *Helix variabilis* particularly.

Helminthia echioides, which grows to a fair altitude in France, cannot be a good characteristic, if this impurity is alone, except on condition that its fruits are found in very great abundance in the parcel to be examined. The same may be said of *Centaurea solstitialis*, for the same reasons.

The presence of isolated *Rubus* stones is perhaps a better characteristic; but certainly that which is the most sure is the presence of seeds of *Coronilla scorpioides*. I have just been studying in detail the distribution of this plant in France, and remember that, from the discussion of the results obtained, we must consider

the seeds of this leguminous plant, even when isolated and in small quantity, as absolutely characteristic of the South.

These studies, made about ten years ago, were worth repeating, as are similar studies from time to time, as changes in the distribution of fodder crops may have brought about modifications in the area of extension of all these adventitious plants.

With this object, during the course of the months of July and August, I have studied the flora in the south-east of France, and more particularly in the departments of Vaucluse, the Bouches-du Rhône, Var, the Maritime Alps, the Basses-Alpes and the Hautes-Alpes. The following are the results which I have obtained.

SAINT-REMY DE PROVENCE AND THE NEIGHBOURING DISTRICTS. — The adventitious flora of this district, so interesting from the crop point of view, so distinctly characteristic of the Provence, by its aspect and its horizons, includes amongst the most widely diffused species, the following plants: *Asteriscus spinosus*, *Helichrysum Stoechas*, *Centaurea paniculata*, *Trifolium stellatum*, *Trifolium augustifolium*.

These, in the clover fields, lucerne fields, waste lands and grass-covered uplands of the neighbourhood of the Alpilles. Then, in the plain covered with fodder and vegetable crops, irrigated for the most part: *Bonjeania recta*, *Centaurea solstitialis*, *Helminthia echioides*, these two latter species, very well diffused, particularly the second, which covers whole fields. *Coronilla scorpioides* is found here and there.

Finally, in a general way, the species which serve to characterise the southern origin of the lucernes and clovers are found here. It is the same with the presence of fragments of small shells (*Helix variabilis*) above all. These molluscs, in dry weather, take refuge on plants, even when dead and brittle, in masses which are sometimes so close, that they simulate clusters of fruit. The same phenomenon must take place at the time of the harvesting of grain, whence, as a result of the threshing, the presence in the seeds of fragments, sometimes very abundant, of the shells of these animals.

Definitively, the adventitious species characteristic of this region, in order of abundance, are: *Helminthia echioides*, *Centaurea solstitialis*, *Coronilla scorpioides*

To these must be added as complementary characteristics giving still further exactitude, in order of importance: *Trifolium*

augustifolium, Trifolium stellatum, Bonjeania recta, Centaurea paniculata.

Bonjeania recta is found in abundance on the border of the crops by, and in the neighbourhood of, the irrigation canals. These seeds, which resemble slightly those of fenugreek, are quite characteristic.

Avignon and the neighbouring districts. — Cultivated fields between le Thor and l'Isle-sur-Sorgues. The adventitious species met with here are, in order of abundance: *Centaurea solstitialis, Helminthia echioides, Trifolium stellatum* and *Trifolium augustifolium, Centaurea maritima.*

The same general characteristics are evident as in the district of Saint-Rémy, but here there is extreme abundance of *Centaurea solstitialis.*

To the preceding plants can be added the following species: *Bromus madritensis, Bromus rubens, Hedypnois polymorpha.* The last is extremely abundant in dry places.

District of Marseilles and neighbouring districts — Aix. — In a general way, the adventitious vegetation of this district is analogous to that of the district of Saint-Rémy. Attention is drawn to the very great abundance of *Helminthia echioides* in lucerne and clover fields. This plant is also found in great abundance in grass-lands, and is even met with in the grass plots of Phare and the Parc du Prado.

The flora of the Basses-Alpes and the Hautes-Alpes, in the districts where clover and lucerne are cultivated, is analogous with that of the preceding Departments, in that the characteristic impurities are the same.

Conclusions. — The adventitious plants characteristic of the South are, in general, identical with those which have been pointed out formerly, and the conclusions drawn in 1914 are exactly the same to-day.

We will consider as being of southern origin the clovers and lucernes containing, say, all the four following species: 1. *Coronilla scorpioides,* 2. *Helminthia echioides,* 3. *Centaurea solstitialis,* 4. small stones of *Rubus* sp. or, in the absence of *Coronilla scorpioides,* species 2 and 3, on condition that we find considerable quantities of their fruits in the samples to be examined.

The following species: *Trifolium stellatum* and *Trifolium augustifolium, Bonjeania recta, Bromus rubens* and *Bromus madritensis,*

Hedypnois polymorpha, supply interesting information, but are not at all necessary to certify that a clover or a lucerne comes from the South, if, amongst its impurities, the sample contains some seeds of *Coronilla scorpioides*, or in its absence, considerable quantities of seeds of *Helminthia* and *Centaurea solstitialis*.

Complementary information which may be take into account, is given by the presence of *Rubus* stones and the remains of shells of *Helix variabilis*.

***

I will terminate this series of studies by the following memorandum, the result of investigations carried out during the summer and autumn of 1923.

On the presence of *Trifolium supinum* Savi, in France.

Historic. — There was repeatedly pointed out, during the course of the last century, the appearance in France of an Italian leguminous plant: *Trifolium supinum* Savi, of which the nearest areas to our country are southern and central Italy. But, the most recent general French floras, namely, Flore de Rouy, of l'Abbé Coste, and the flora in course of publication by Gaston Bonnier, make no mention of this plant. *Trifolium supinum*, therefore, does not exist officially in the floras of our country.

Let us now study the local floras: *Trifolium supinum* is mentioned for the first time, at least to my knowledge, in 1915 by A. P. de Dandolle at Port Juvénal near Montpellier (1). Then at the same place by Delille (2) in 1826-29. Mentioned again in 1828 in the second edition of the *Botanicon Gallicum* in the neighbourhood of Nîmes and Montpellier (3).

In succession, A. Mutel (1834) in his *Flore Française* (4) mentions the plant at Port Juvénal and at Nîmes: Touchy (1835), Dunal (1841), Grenier and Godron (1848) *Flore de France*, Godron (1854) *Flora Juvenalis*, Toucky (1863) mention *Trifolium supinum* in the same locality (5-6-7-8-9-10).

In other districts, the history of the appearances of the plant is as follows:

Grenier in 1857 (*Florule exotique des environs de Marseille*) mentions the presence of the plant at Catalans and Belle de Mai,

where it had been found by MM. BLAISE and ROUX (11-12). These last two mention it again in 1858 at Marseilles. These areas no longer exist to-day.

Later, in 1882, de FONTVERT and ACHINTRE, in their *Catalogue des Plantes vasculaires des environ d'Aix en Provence* (15) mention that they found *Trifolium supinum* at the edge of a field at la Pioline; mentioned again the following year by SAINT-LAGOR in his *Catalogue des plantes vasculaires de la vallée du Rhône* (16).

Outside the preceding districts, *Trifolium supinum* has been mentioned by DE MARTRIN-DONOS (14) in 1864, in the *Florule du Tarn*, in the neighbourhood of Castres, and has not been seen again since. The existence of this clover is found again, mentioned in the *Catalogue des plantes de Provence* (17) by SHUTTLEWORTH, HUET, JACQUIN and HENRY (1889) at Antibes (THURET), Toulon (AUZENDE), Marseilles (ROUX and BLAIZE), an indication which is probably no other than that given by these authors in 1858.

Later, BURNAT (18), in his *Flore des Alpes Maritimes* (1896), mentions that the *Trifolium supinum* of the THURET herbarium, gathered at Antibes, has been introduced, with other clovers, into the Department of Var.

Let us add, moreover, that the most recent work of ALBERT (19) *Catalogue des plantes du Var* (1908) neither mentions the plant at Toulon nor in any other locality in this department. Finally, M. A. RÉGNIER (20), in his *Flore phanérogamique des Bouches-du-Rhône* (1910), mentions solely the district of la Pioline, indicated above, a district which, moreover, has long ceased to exist.

On the other hand, M. LECOMTE, Professor at the Museum d'Histoire Naturelle, having placed at my disposal the herbarium of adventitious plants, I found there several samples of *Trifolium supinum*, gathered at the following stations: Port Juvénal, REQUIEN (1845); Port Juvénal, GODRON (1853); La Belle de Mai — in the crops — BLAIZE and ROUX (1856); Saint Tronc — in ruins — BLAIZE and ROUX (1857); Les Olives, — in a field — H. ROUX (1860), districts situated near Marseilles or even on the threshold of this city.

Thuret herbarium: Meadows sown with the sweepings of haylofts, coming from Grasse (May 1863).

Cheverny (Loir-et-Cher) (1871), along the walls of the park, indication drawn from the herbarium of M. FRANCHET (1882).

Finally, the most recent information comes from the district

of Marseilles, where a botanist, M. Blanc, has met with a clover on the thrashing floor of the "La Pauline" mill at La Valentine on the 11th June 1916, and has not seen it again since (9).

In short, the *Trifolium supinum* Savi, introduced from time to time with foreign wool or seeds, has only been met with casually, in a sporadic state, especially in Provence, and has never been seen again in the districts where it was reported, except when re-introducted.

Necessity of an enquiry on the spot. — Such was the state of the question when the attention of the Station d'Essais de Semences was drawn to this plant by the following facts: A certain number of French merchants, having sent to Switzerland samples of purple clover seeds, found the authenticity of the origin of their seeds contested, owing to the presence, amongst the natural impurities of these seeds, of seeds of *Trifolium supinum*. Let us add that, on verification, the presence of *Trifolium supinum* in the suspected seeds was absolutely certain.

The following facts may now be mentioned: For some years past we have found coming into France enormous quantities of clover and lucerne seed of Italian origin.

To what requirements does this arrival in France of such quantities of seed correspond?

We find ourselves met with two alternatives: Either, these seeds, owing to the change of the moment (10) and to meet the demand, have been bought at a relatively low price, with the sole object of selling them again, pure or mixed with the seeds of our own country, as French seeds, at a much higher price; or, they have served to form clover fields or lucerne fields intended for the production of seed.

In this latter case, it could happen that seeds of *Trifolium supinum* might be found in the seeds harvested on our territory; and it might happen, as has already occurred, that this impurity would have spread, and persisted in some favourable spots. In this case, seeds really French might be wrongly considered to be Italian. The question being of great importance, it was fitting to collect all the information likely to throw light on it, and to begin by going to the place, particularly the south-west, to travel through the following Departments: Vaucluse, Bouches-du-Rhône, Var, Alpes Maritimes, Basses-Alpes and Hautes-Alpes, in order to seek the plant in the districts where is has formerly been men-

tioned; then, in a general way, in the existing crops of crimson clover.

This journey for study was undertaken at the beginning of July, and was prolonged into September. I will not dwell on the marches and counter-marches necessitated by plant-collecting made with a fixed object, and extended over five Departments, often under unpleasant conditions as regards temperature. The result alone is of importance.

In all the districts where the presence of *Trifolium supinum* had been indicated, I found it impossible to find the least trace of the plant.

Amongst all the plant collections made in the districts where clover and lucerne are cultivated, I never once found it.

CONCLUSIONS. — This annual plant may have appeared sometimes as a botanical rarity, but has never persisted, and in any case has never been sufficiently abundant to constitute by its seeds a natural impurity of cultivated French clovers.

The negative results of these researches have been confirmed by information which has been supplied to me by some regional botanists of the highest authority. All, including myself, are unanimous in considering *Trifolium supinum* to be a fugitive species, very rare, and the appearance of which can never constitute anything but an accidental occurrence.

We are therefore induced to say that a clover cultivated on our soil never contains seeds of *Trifolium supinum* amongst its natural impurities.

In order to be absolutely sure I asked the Directors of the Agricultural Administrations of the Departments which I visited, to have sent to me samples of authentic origin, from which we could ascertain whether, after all, there might not be found some isolated seeds of this plant. This was a supplementary precaution. I received a certain number of these samples, and in none of them have I found the presence of this impurity, nor of *Hedysarum coronarium*, the seeds of which are so abundant in Italian clovers.

Such are the examples which I have chosen. They enable us to see the great practical importance and magnitude which questions of origin sometimes assume, and also show the scientific interest which is attached to the solution of similar problems. Sys-

tematization, geology, and botanical geography play a most important part here, and are the surest guides to depend upon, with the certainty of reaching the object which it was proposed to attain.

LOUIS FRANÇOIS,

Doctor of Science, Chief of Laboratory of the Station d'Essais de Semences, Paris.

NOTES.

(1) The seeds of the 2nd and 3rd groups constitute a whole which is often designated by the term "foreign seeds", that is to say, not belonging to the species forming the lot to be examined.

(2) Such is the commercial denomination of this wheat, which, in reality, does not correspond to a single type, but is formed by a mixture of several varieties.

(3) NATHANIEL, LORD BRITTON, Ph. D. and Hon. ADDISON BROWN. An illustrated Flora of the Northern United States, Canada, and the British possessions, from Newfoundland to the parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean westward to the 102 meridian. Vol III, 1898 (Appendix).

(4) *Ibidem*, Vol. III, (1898).

(5) Including Algeria and Tunis.

(6) See also the classification of Messrs. DENAIFF and SIRODOT: Oats.

(7) Correspondents; MM. D'ALVERNY, CHARRIER, CHÂTEAU, ABBÉ COSTE, DOUTEAU, DURNAND, FÉLIX, HANNEZO, ABBÉ HERVIER, ABBÉ HY. DE KERSER, LAURENT, LE GENDRE, DE LITARDIÈRE, M. MOREL, PASCAUD.

(8) The figures between (*) refer to the table annexed to this memorandum.

(9) Correspondents: MM. ARBEST, BELLE, CABANÈS, Abbé COSTE, DAGAN, Abbé DOLMAS, DUFFOUR, GALINAT, GERMAN, JEAN, LEMÉE, MARTY.

(10) Year 1923 and preceding.

BIBLIOGRAPHY.

I. — GENERAL WORKS.

1778. LAMARK de, *Flore française.*

1805-15. LAMARK de and CANDOLLE de, A. P. *Flore française.*

1806. do., *Synopsis plantarum in Flora gallica descriptarum.*

1828. DUBY, *Botanicon gallicum.*

1828. LOISELEUR DESLONGCHAMPS, *Flora gallica.*

1834. MUTEL, A., *Flore française.*

1848. GRENIER and GODRON, *Flore de France.*

1893. ROUY and FOUCARD, *Flore de France.*

1901. COSTE Abbé, *Flore de France.*

BONNIER, Gaston, *Flore complète de France, Suisse et Belgique* (in course of publication).

II. — Works relating to the South-East.

1813-15. GUÉRIN, *Flore des environ de Vaucluse* (contained in: Description de la fontaine de Vaucluse).
1826. RISSO, *Flore de Nice et des Alpes-Maritimes.*
1850. HANRY, *Catal. des plantes vascul. du Var.*
1857. GRENIER, *Florule exotique des environs de Marseille.*
1862. CASTAGNE et DERBÈS, *Catal. des plantes qui croissent naturellement dans le département des Bouches-du-Rhône* (Catalogue of plants which grow naturally in the Department of the Bouches-du-Rhône).
1867. PALUM. *Catal. des plantes phanérog. qui croissent spontanément dans le territoire d'Avignon et dans les lieux circonvoisins.* (Catal. of plants growing spontaneously in the territory of Avignon and the surrounding places).
1869. FOURREAU, *Catal. des plantes qui croissent le long du cours du Rhône.* (Catal. of plants which grow along the course of the Rhône).
1872. VERLOT. *Catal. des plantes vasculaires du Dauphiné.*
1879. ARDOINE, *Flore analytique du département des Alpes-Maritimes.*
1879. PERROUD, *Herborisation dans le Luberon.*
1881. ROUX, H. *Catal. des plantes de Provence.*
1882. FONTVERT, de, and ACHINTRE, *Catal. des plantes vasculaires des environs d'Aix.* (Catal. of vascular plants of the neighbourhood of Aix)
1883. SAINT LAGER. *Catal. des plantes vasculaires de la vallée du Rhône.* (Cat. of vascular plants of the Rhône valley).
1895. ROUIS, *Notes sur la flore phanérog. des environs de Carpentras, du Ventoux et des Monts de Vaucluse.* (Notes on the phanerog. flora of the neighbourhood of Carpentras, the Ventoux and the Monts de Vaucluse),
1897. CARIOT and SAINT LAGER, *Flore du bassin moyen du Rhône et de la Loire.*
1897. LANNES, *Catal. des plantes les plus remarquables croissant dans le bassin supérieur de l'Ubaye entre* 1163 *and* 3090 *m., revisé par Ch. Flahault en* 1897. (Cat. of the chief plants growing in the upper basin of the Ubaye between 1163 and 3090 m.).
1892-1906. BURNAT, *Flores des Alpes-Maritimes.*
1908. ALBERT, *Catal. des plantes du Var (néant).*
1910. REGNIER, A., *Flore phanérogamique des Bouches-du-Rhône.*
1912. THELLUNG, A., *Flore adventice de Montpellier.* An indication number is placed above the extracts from this work in order of date. A. O. de CANDOLLE 1815, DELILLE 1827-29, TOUCKY 1835-51-63, DUNAL 1841, GODRON 1851, BLAIZE and ROUX 1858.
RAVAUD, Abbé, *Guide du Botaniste dans le Dauphiné* (12 pamphlets bound together, undated).

III. — Cévennes and Languedoc.

1836. SERRE, *Flore abrégée de Toulouse.*
1854. ARRENDEAU, *Flore toulousaine.*

1856-62. POULZOLZ de, *Flore du Gard.*
1864. MATRIN-DONOS de, *Florule du Tarn.*
1876. MÉHU and SAINT LAGER, *Flore du Pilat.*
1876. LORET and BARRANDON, *Flore de Montpellier.*
1907. SUDRE, *Flore toulousaine.*
1910. RÉVEL, *Catal. des plantes vascul. du département de l'Ardèche.*
1912-13. GAUTHIER, G. and MARTY, *Catal. de la Flore des Cerbières.*

IV. — PYRÉNÉES AND SOUTH-WEST.

1826. BENTHAM. *Catal. des plantes indigènes des Pyrénées et du Bas-Languedoc.*
1847. FOSSAT, Labrèze, *Flore du Tarn-et-Garonne.*
1847. DUPUY, Abbé, *Florule du département du Gers.*
1852. PUEL, *Catal. des plantes du département du Lot.*
1857. ZETTERSTEDT, J. E., *Plantes vasculaires des Pyrénées principales.*
1859. PHILIPPE, *Flore des Pyrénées.*
1867. DULAC, Abbé, *Flore du département des Hautes-Pyrénées.*
1882. CLAVAUD, *Flore de la Gironde.*
1885. REVAL, J., Abbé, *Essai de la Flore du Sud-Ouest de la France.*
1898. GAUTIER, G., *Catal. raisonné de la Flore des Pyrénées-Orientales.*
1909. BERGERET, *Flore des Basses-Pyrénées.*

V. — CENTRE AND WEST.

1842. DELASTRE. *Flore de la Vienne.*
1849-57. BOREAU, *Flore du Centre de la France et du bassin de la Loire.*
1866. MIGOUT, *Flore de l'Allier.*
1873. LEGRAND, *Statistique botanique du Ferez.*
1875. POIRAULT, *Catal. des plantes vascul., de la Corrèze.*
1877. LAMOTTE. *Prodrome de la Flore du Plateau Central.*
1883. GUSTAVE Frère, and HÉRIBAUD, Frère, *Flore d'Auvergne.*
1884. RUPIN, *Catal. des plantes vascul. de la Corrèze.*
1885. FRANCHET, *Flore du Loire-et-Cher.*
1890. GRESNIER, Jullieu, *Catal. des plantes vascul. du Loiret.*
1894. GRAND LE, *Flore analytique du Berry.*
1898. LLOYD, J., *Flore de l'Ouest de la France.*
1906. DOUTEAU, *Flore de Vandée.*

TRIFOLIUM SUPINUM.

(Bibliography):

DATES AND LOCALITIES WHERE THE PLANT HAS BEEN FOUND.
(In this case it is only a question of the particulars given in the Floras).

Localities.

1915. 1. Mentioned by SALZMAN, according to A. P. DE CANDOLLE at Port Juvénal.
1827-29. 2. Mentioned by DELILLE at Port Juvénal.
1828. 3. *Botanicon gallicum seu synopsis plantarum in Flora gallica descriptarum.* Editio seconda ex herbaris et schedio candollianis propriisque digestum a J. E.
DUNY (1828). The plant is mentioned in the neighbourhood of Nîmes and Montpellier.
1834. 4. A. MUTUEL, *Flore française*, Port Juvénal, Nîmes.
1835. 5. TOUCHY. Port Juvénal.
1841. 6. DUNAL, Port Juvénal.
1848. 7. GRENIER and GODRON, *Flore de France*, mention *T. supinum* amongst the species excluded, Plant introduced at Port Juvénal near Montpellier.
1851. 8. GODRON. Port Juvénal.
1851. 9. TOUCHY. *Id.*
1854. 10. GODRON, *Flora Juvenalis et migration des végétaux.* Port Juvénal.
1857. 11. GRENIER, *Florule exotique des environs de Marseille.* Mentions the plant in the crops at Catalans, at La Belle de Mai.
1858. 12. BLAIZE and ROUX. Marseilles.
1863. 13. TOUCHY, Port Juvénal.
1864. 14. MARTRIN-DONOS de: *Florule du Tarn*, neighbourhood of Castres à Fitelle (Vallette).
1882. 15. FONTVERT, de, and ACHINTRE: *Catal. des plantes vasculaires des environs d'Aix*, on the border of a field at La Pioline.
1883. 16. SAINT-LAGOR: *Catal. des plantes vasculaires de la vallée du Rhône*; repetition of the preceding indication.
1889. 17. SHUTTLEWORTH, HUET, JACQUIN and HONRY: *Catal. des plantes de Provence.* Antibes (THURET), Toulon (AUZENDE), Marseilles (ROUX and BLAIZE).
1896. 18. BURNAT: *Flore des Alpes-Maritimes.* The *T. supinum* of the THURET herbarium, gathered at Antibes, was, with other species of *Trifolium*, introduced into the Var.
1908. 19. ALBERT: *Catal. des plantes du Var* (Néant).
1910. 20. REGNIER, A.: Flore *phanérogamique des Bouches-du-Rhône*: reproduces the indication given by de FONTVERT and ACHINTRE.
1912. 21. THELLUNG, A.: *Flore adventice de Montpellier.* A certain number of indications extracted from this work are given above in the order of their date. — CONDOLLE de A. P., (1815), DELILLE (1827-29), TOUCHY (1835-51-63), DUNAL (1841), GODRON (1851), BLAIZE and ROUX (1851).

INVESTIGATION IN REGARD TO WEED SEEDS FOUND AMONG THE SEEDS OF ARGENTINA, WITH REFERENCE TO THEIR ORIGIN AND DISTRIBUTION IN THE PRODUCING DISTRICTS OF ARGENTINA.

Owing to the numerous analyses carried out during a period of more than twenty years it was possible to determine the weed seeds which usually accompany our cultivated seeds such as lucerne, flax, wheat, barley, oats, rice, canary seed, grass seed, etc.

Lucerne takes the first place among these seeds on account of the variety of the weed seeds contained in it, of native as well as of foreign origin, depending upon the seasons and the countries from which the seeds are imported. Argentina can be divided into two large zones of these weed seeds, for instance, the irrigated and the unirrigated areas, with their various sub-zones or regions.

I. Zone of irrigated land.

1. The National Territory of " Chubut. "
2. The National Territory of " Rio Negro. "
3. The Province of " Mendoza " and the National Territory of Neuquen. "
4. The Province of " San Juan. "

The first three areas produce more seed than local consumption requires, the surplus being sent to Buenos Ayres where it is sold to districts not producing lucerne seed, and if free from *Cuscuta*, is exported to other countries. The fourth area only produces enough seed for its own requirements, with the exception of San Juan, the seed of which is frequently sent to Rosarion de Santa Fé, to be sold there for sowing in the Province of Santa Fé.

As all the seeds of these areas originate in irrigated districts it is easy to understand that many weed seeds are to be found among the seed coming from the South as well as among those from the North. Others indicate perfectly the region of origin and must, therefore, be considered as indicator-seeds for determination of the place of origin.

(1) Lucerne weed seeds from Chubut. The indicator-seeds of this region are marked with a*.

Anoda triangularis (Willd.)	(isolated seeds),
Brassica nigra Koch.*	(in moderate quantities)
Carex sororia, Kth.*	(» » »)
Cirsium lanceolatum Scop.	(» small »)
Cuscuta chilensis Ker. (Probably imported from Chile)	(» » »)
Grindolia brachystophana Grisb.	(isolated seeds).
Luzula patagonica Speg.*	(isolated seeds)
Melilotus parviflorus Desf.	(in moderate quantities)
Polygonus campestre Lmk.	(in small quantities)
» *chilense* Meisn.	(in large quantities)

(characteristic of Chubut when present in a very large quantity).

(2) Lucerne weed seeds from Rio Negro. The indicator-seeds of this region are marked with a*.

Cassia aphylla Grisb.*	(in small quantities)
Cuscuta chilensis Kor.	(» » »)
Cuscuta racemosa Mart.	(» » »)
Cirsium lanceolatum Scop.	(» » »)
Melilotus parviflorus Desf.	(» large »)
Polygonum campestre Lmk.	(» small »)
Polygonum chilense Moisn.	(» » »)
Rumex magellanicus Grisb.	(» » »)
Sphacele hastata Grisb.	(» » »)

*Suaeda divaricata** Moq. sometimes, then in large quantities.

(3) Lucerne weed seeds from Mendoza and Neuquen. The seeds from Neuquen have, so far, been fairly free of weeds.

Amaranthus clorostachys Willd.	(in small quantities)
Chenopodium hircinum Schrad.	(» » »)
Chenopodium murale L.	(» » »)

(These three seeds are also frequently to be found among the seeds of un-irrigated lands).

Cuscuta racemosa Mart.	(in large quantities)
» *chilense* Ker.	(» small »)
Lactuca Scariola L.	(» » »)
Melilotus parviflorus Desf.	(» large »)
Nicandra physaloides Gärtn.*	(» small »)
Panicum colonum L.* very frequent	(» » »)
Polygonum chilense Meisn.	(» » »)
Rumex conglomeratus Murr.	(» » »)
» *magellanicus* Grisb.	(» » »)
» *pulcher* L.	(» » »)
Setaria imberbis Roem.	(» » »)
Setaria leiantha Hack*	(» moderate »)
Sphacola hastata Grisb.	(» small »)

(4) Lucerne weed seeds from San Juan, part of San Louis, the North of Corboda, Ta Rioja, Catamarca, Santiago del Estero, Tucuman, Salta, Jujuy. The indicator-seeds of the region are marked with a[a].

Anoda triangularia (Willd) DC	(in small quantities)
Bidens leucanthus Willd*	(» » »)
Bidens scabiosoides, N. et Arn.*	(» » »)
Chenopodium opulifolium Schrad.	(» » »)
Cuscuta chilensis Ker.	(» moderate »)
» *racemosa* Mart.	(» large »)
Lippia modiflora Rich.*	(» small »)
Melilotus parviflorus Desf.	(» large »)
Modiola lateritia (Hock.) Schm.*	(» small »)
Modiola malvifolia Grisb.*	(» » »)
Paspalum plicatulum Michx.*	(» » »)
Schkuhria Bonariensis L.*	(» » »)
Sida rhombifolia L.*	(» » »)
Sphacele hastata Grisb.	(» » »)

II. Zone of unirrigated lands.

(1) The South of the Province of Buenos Ayres and the South of the General Pampas.

(2) The West of the Province of Buenos Ayres, the North of the Central Pampas and the South of the Province of Cordoba.

Lucerne seed from the unirrigated lands is generally preferred both for home sowing and export.

These two areas differ but little as regards the quantity of weed seeds, but the seed of the South is usually purer than that of the West. Moreover, the latter has a larger variety of weed seeds. Naturally many of these seeds are also to be found among the seeds from the irrigated lands, but then, as a rule, as isolated grains, whereas among the seeds of unirrigated lands they are generally present in large quantities. Others, on the contrary, show by their characteristics that the seed originates in unirrigated lands.

Weed seeds which are frequently present in larger quantities among lucerne seed of the Southern area, although they are also to be found among the seed of the Western area.

Atriplex pamparum Spg.	(in large quantities)
Centaurus solstitialis L.	(» » »)

(Imported from Italy, this plant has spread to such an extent that it has almost become a plague).

Cirsium lanceolatum Scop. often but	(in small quantities)
Fumaria capreolata L.	(» moderate »)
» *officinalis* L.	(» » »)
Melilotus parviflorus Desf.	(» » »)
Polygonum chilense Meisn.	(» » »)
Rynchosia Senna Gil.	(isolated »)
» *texana* Grisb.	(» »)
Rumex magellanicus Grisb.	(in moderate quantities)
Setaria italica P. B.	(» » »)
Solanum maritimum Mey.	(» » »)
Cuscuta chilensis Ker.	(» small »)
» *racemosa* Mffrt.	(» » »)
» *Trifolii* Babingt.	(» » »)

Lucerne weed seeds from the West, from Buenos Ayres, the Northern and Central Pampas and the South of Cordoba. — (Pampas formation, continental climate). The indicator-seeds are marked with a^{x}.

Amaranthus clorostachys Willd. (often in moderate, but sometimes (in large quantities)

Ambrosia tenuifolia Spr.* sometimes and then (in large quantities)
Anthemis Cotula L. (» small »)
Ammi Visnaga (L.) Lmk.* often (» moderate »)
Brassica campestris L.* (» small »)
Bromus unioloides H.B.K. (» » »)
Cenchrus tribuloides L.* (» » »)
Centaurea melitensis L. (» » »)
» *calcitropa* L. (» » »)
» *solstitialis* L. (» » »)
Chenopodium album L. (» moderate »)
» *ambrisioides* L. very often (» large »)
» *hircinum* Schrad. (» » »)
» *murale* L. (» » »)
Cuscuta racemosa Bart. (» moderate »)
» *chilensis* Ker. (» small »)
» *Trifolii* Babingt. (» » »)
Cyperus paniceus Boek. (» » »)
Digitaria sanguinalis Scop. (» large »)
Eleusine indica L. var. *tristachya**) (» small »)
Euxolus muricatus Gil. (» » »)
Hordeum halophilum Grisb. (» » »)
Lepidium pubescens Desv. often (» moderate »)
Lythrum hyssopifolia L.*) sometimes (» small »)
Melilotus parviflorus Desv. » (» moderate »)
Onopordon arabicum L.*) » (» small »)
Oryzopsis ovata (Tr. et Rup.) Speg.*) (» » »)
Oryzopsis tuberculata (Desv.) Speg.*) (» » »)
Panicum Bergi Arechev.*) (» moderate »)
Paspalum vaginatum Swrtz. (» small »)
Panicum capillare L.*) (» » »)
Physalis viscosa L. (» » »)
Phalaris intermedia Bose*) (» moderate »)
Plantago patagonica Jack. var. *typica* Speg.*) indicator-seed of the Pampas often (» » »)
Polygonum convolvulus L. sometimes (» » »)
Roubieva multiflora Moq. (» » »)
Rumex conglomeratus Murr. often (» » »)
Rumex crispus L. » (» » »)
Rumex obtusifolius L. (» » »)

Rumex magellanicus Grisb.	often	(in moderate quantities)
Rumex pulcher L.	»	(» » »)
Setaria imberbis Roem.	»	(» » »)
Sisymbrium columnae Jacq.		(» small »)
Stipa hyalina Nees ; *)		(» » »)
Stipa setigera Prsl. var. (*pusilla**)	often	(» moderate »)
Stipa tenuissima Tr.		(» » »)
Verbena gracilescens Cham*)		(» » »)

In addition, seeds imported for reproduction purposes :

Cichorium Intybus L.	sometimes	(in small quantities)
Cynodon Dactylon Pers.	»	(» » »)
Plantago lanceolata L.	»	(» » »)

Although these three plants have spread to such an extent that *Cynodon Dactylon* may already bec onsidered as a plague of the lucerne fields, their seeds are only found sometimes and in small quantities among the seeds of lucerne.

When the indicator-seeds above mentioned are present in large quantities it is a sure proof that they originate from unirrigated lands.

S u m m a r y : Lucerne seed froms irrigated lands, which comes on the market usually contains the following seeds in large quantities :

Melilotus parviflorus Desf., *Polygonum chilense* Meisn., *Rumex magellanicus* Grisb., *Suaeda divaricata* Hoq.

In small quantities : *Brassica nigra* Koch., *Carex sororia* Kth. *Cassia aphylla* Grisb., *Grindelia brachystephana* Grisb., *Panicum colonum* L., *Sphacele hastata* Grisb.

In addition, in many cases :

Cuscuta racemosa Mart., *Cuscuta chilensis* Ker.

Lucerne seeds from unirrigated areas usually contain the following seeds :

In large quantities : *Amaranthus clerostachys* Willd., *Chenopodium ambrosoiides* L., *Chenopodium hircinum* Schrad., *Chenopodium murale* L.

In smaller quantities : *Bromus unioloides* H. and K., *Centaurea melitensis* L., *Cirsium lanceolatum* Scop., *Fumaria capreolata* L., *Lepidium pubescens* Desv., *Lolium multiflorum* Lmk., *Melilotus parviflorus* Desf., *Panicum Bergi* Arech., *Setaria imberbis* Roem.

Sometimes, in addition : *Cuscuta chilensis* Ker., *Cuscuta racemosa* Mart., *Cuscuta Trifolii* Bab.

The table gives the mean values of the coefficients concerned, and information as to the quality of the lucerne seed grown in the different areas and the dissemination of the Casento. These statements represent the results of investigations extending over many years.

WEED SEEDS OF FLAX.

Although flax is not so extensively cultivated as lucerne and is more limited to the Central Provinces, yet the weed seeds contained in it are somewhat of the same nature. In consequence it is not possible to determine by them the place of origin of the flax seed.

The flax weed seeds are as follows, the most frequent being marked with a +:

Agrostemma Githago L., *Amaranthus clorostachys* Willd., *Ammi Visnaga* (L.) Lmk., *Anthemis Cotula* L.*), *Argemone mexicana* L., *Avena fatua* L., *Bromus unioloides* H. and H., *Camelina dentata* Pers., *Chenopodium hircinum* Schrad., *Chenopodium murale* L., *Centaurea melitensis* L., *Convolvulus arvensis* L., *Datura Stramonium* L., *Echium violaceum* L., *Galphinia brasiliensis* Juss., *Lepidium pubescens* Desv., *Lithospermum arvense* L., *Lolium multiflorum* Lmk., *Lolium temulentum* L., *Melilotus parviflorus* Desf., *Panicum Bergi* Arech., *Phalaria canariensis* L., *Phalaris intermedia* Bose.*, *Polygonum chilense* Meisn., *Polygonum Convolvulus* L.*, *Raphanus sativus* L., *Rapistrum rugosum* All., *Rumex* sp., *Setaria imberbis* Roem., *Silybum Marianum* Gaertn., *Vaccaria segetalis* (Nock) Garcke, *Avena sativa* L., *Brassica campestris* L., *Bromus unioloides* H. and K.

WEED SEEDS OF WHEAT.

The place of origin of wheat is, like flax, not to be determined by the weed seeds, as these are more or less alike in all the wheat areas. At most it can be said that in the Central and Northeru provinces *Lolium temulentum* L. and *Hordeum vulgare* L. are present in large quantities, whereas in the South, *Agrostemma Githago* L. predominates. The same can be said of the Province of Entre-Rios, in which the seed of the Eastern districts on the Rio Uruguay, show more *Agrostemma Githago* L., *Vaccaria segetalis* (Neck.) Garcke and also *Galphinia brasiliensis* Jass, whereas in those of the Western districts on the Rio Parani larger quantities of *Lolium temulentum* L., *Polygonum Convolvulus* L. and *Calepina Corvini* Dess. are present.

The following are the weed seeds of wheat of which those present most frequently and in larger quantities are marked with a+ : *Agrostemma Githago* L.*), *Avena fatua* L.*), *Avena hybrida*, Koch., *Avena sativa* L., *Calapina Corvini* Desv., *Cynara cardunculus* L., *Echium violaceum* L., *Calphinia brasiliensis* Juss., *Hordeum vulgare* L.*, *Lithospermum arvense* L., *Lolium temulentum* L.*, *Melilotus parviflorus* Desf., *Polygonum Convolvulus* L.*), *Raphanus sativus* L.*, *Rapistrum rugosum* All. (not often, but sometimes in large quantities), *Silybum Marianum* Gärtn., *Vaccaria segetalis* (Neck) Garcke, *Xanthium italicum* Moretti, *Xanthium spinosum* L.

In the case of other cereals such as barley oats and rye, similar weed seeds are found but less frequently and in smaller quantities. Oats usually contain much barley, wild-oats and sometimes seeds of *Caucalis daucoides* L. in moderate quantities. In addition *Polygonum Convolvulus* L. and *Lolium temulentum* L. are the weed seeds found most frequently.

Weed seeds of rice :

Much *Panicum Crus-galli* L. is found in the rice of the Cuyo Provinces (Mendoza, San Juan) ; the following seeds are found most frequently and in considerable quantities in the rice of the Northern Provinces (Tucuman, Salta, Jujuy) : *Modiola lateritia* (Heck) Schm., *Modiola malvifolia* Grisb., *Sida rhombifolia* L., in addition, *Digitaria sanguinalis* Scop., *Panicum insulare* L. Mey, *Paspalum plicatulum* Mohx., *Polygonum Persicaria* L. *Panicum Crus-galli* and *Polygonum persicaria* L. are probably reproductions of imported seeds.

Weed seeds of Canary Seed (*Phalaris canariensis* L.) : *Brassica campestris* L., *Lolium multiflorum* Lmk., *Lolium temulentum* L., *Polygonum Convolvulus* L., *Silene gallica* L.

Weed seeds of *Lolium Multiflorum* Lmk. and *Bromus unioloides* He. and K.

Of these two grasses, *Lolium* seed is more largely collected and is cultivated as a by-product, and as a cleaning crop for wheat and flax. Consequently, it often contains some of the same weeds as flax and on the other hand small grains of wheat, Of course such seeds as are noticeably different in form, size and weight from the seeds of *Lolium* are excepted.

Bromus is harvested in a clean condition and is cultivated also

as a cleaning crop for wheat and sometimes also of lucerne. It contains but few weeds, in place of which however small grains of wheat and isolated seeds of lucerne are to be found, mainly in the husks: *Medicago denticulata* Willd., *Medicago maculata* Willd. of which the first species predominates.

Brassica campestris L. is also grows as a cleaning crop of flax, hence contains some of the weeds of flax, especially sorrel seed (*Rumex* sp.) the separation of which is difficult.

This concludes the series of the more important agricultural seeds grown in Argentina, in regard to their specific weeds. The other crops such as, maize, cotton, etc., have either such large sized seeds that they do not contain weed seeds, or are grown to such a small extent, that they are not important.

WALTER VON PETERY,
Director of the Seed Laboratory of the Argentine Ministry of Agriculture, Buenos Aires.

Purity %	Inorganic admixture %	Useful weed-seeds %	Harmful weed-seeds %	Germinating energy %	Sprouted seeds %	Hard seeds %	Dead seeds %	Germinating capacity %	Practical value %	Weight per 100 gm. g.	Cuscuta seeds per kg.
Province of Buenos Aires.											
94.35	4.63	0.21	0.41	66.97	71.30	21.00	7.70	81.80	77.50	1.910	442
56.55 % cuscuta free, 40.30 % with cuscuta, 3.17 % with cuscuta, within the limit of 10 grains per kg.											
Central Pampas.											
94.08	3.59	0.09	2.24	70.75	75.87	17.52	6.61	84.63	79.62	1.905	371
60.60 % cuscuta free, 34.05 % with cuscuta, 5.35 % with cuscuta, within the limit of 10 grains per kg.											
Province of Mendoza.											
94.92	4.23	0.09	0.76	54.05	59.90	36.58	3.52	78.19	74.22	2.010	408
29.06 % cuscuta free, 58.69 % with cuscuta, 12.25 % with cuscuta, but within the limit of 10 grains per kg.											
Northern Provinces, (San Juan, La Rioja etc.).											
94.87	4.97	0.02	0.14	47.50	54.78	40.18	5.04	74.87	71.03	2.036	2373
41.37 % cucusta free, 58.63 % with cuscuta.											
National territory "Rio Negro".											
44.45	2.74	0.02	0.79	57.63	64.81	32.72	2.47	81.17	78.29	2.010	4
79.40 % cuscuta free, 6.60 % with cuscuta, 14.00 % with cuscuta, but within the limit of 10 grains per kg.											

It is of course understood that these data possess only relative value, as giving approximately the characteristics of the seeds of the different regions. It is only by means of an investigation, if possible of a number of samples, representing as nearly as may be the total production, that it is possible to determine the exact coefficients of the seeds, beyond challenge.

Abstracts and Literature.

Uniformity in Seed Testing Reports.

ANDERSON, T. (Director, Seed Testing Station, Board of Agriculture, Scotland).)Paper read at the International Seed Testing Congress 1924). (1).

A proposition is put forward to the effect that seed testing reports should be based on terms of percentage of pure germinating seed and percentage of impurities, and that the figures of germination should be suppressed.

The need for a uniform method of expressing results of analyses of seed samples is considered essential for international trade. This should enable the cultivator to ascertain the relative intrinsic value of the consignment of seed and should afford a fairer index of foreign ingredients.

The author discusses the advantages of such a procedure in detail. The proposed report would show the actual percentage weight, as nearly as can be calculated of the live seed, in contradistinction to the figure for germination which has a certain unreliability. This is considered in relation to the broken and damaged seeds usually excluded from the germination test, which would not affect uniformity of result if expressed in terms of pure germinating seed only, and if broken seeds and broken seedlings are classified together ; estimation of small seeds and shrivelled or unripe seeds, empty glumes, dead seeds and shelled caryopses.

The issue of reports solely on germination or of only partial reports of purity or germination is depreciated.

The suggested form of report, is given as follows :

Pure germinating seed	%
Hard seeds	—
Broken seeds, broken seedlings	—
Empty glumes	—
Impurities (Foreign ingredients)	—

including :

Chaff, inert matter	—
Weed seeds	—
Useful seeds	—
Adapted for a purity separation only	—
Pure seed	—

excluding :—

Broken seed	—
Shrivelled seeds	—
Empty glumes	—
Impurities (foreign ingredients)	—

(1) Full report obtainable at His Majesty's Stationary Office, Adastral House, Kingsway, London W. C. 2. Price eleven shillings and six pence.

including:

Chaff, inert matter etc.	—
Weed seeds	—
Useful seeds	—

The Determination of Moisture in Seeds.

BUCHHOLZ, Y. (Director, Seed Control Institute, Christiania), Tables 2 (1).

The author draws attention to the exceptional difficulties attached to the determination of the moisture content of seeds. The results depend largely on the method of preparation of the sample (degree of grinding); the temperature and the duration of the drying process.

The results of several tests carried out at Christiania, are tabulated and the following method is proposed as useful in all cases of international transactions in seeds.

(a) *For cereals and other large seeds* (dry weight of 1000 grains more than 10 gm) 5 gm. roughly ground substance heated for 4 to 5 hours in a drying oven at 103°C.

(b) *For small seeds* (dry weight as above) 2 $^1/_2$ gm. whole seeds heated as before.

In both cases parallel determinations are important.

The importance of air tight receptacles for samples is emphasized.

In the discussion following this paper, VOIGT (Hamburg) stated that in Germany for certain seeds, a temperature of 98°C. was used and for others 103°C. The seeds were put in a cold oven and heated to the required temperature.

Should not reports on the purity of seeds indicate the percentage by weight of weed seeds and the names of those most plentiful in the samples analysed, and what species are to be described as weeds?

BUSSARD. Léon, Assistant Director, Seed Testing Station, Paris (1).

In discussing the true interpretation of grade, and the confusion frequently caused amongst growers and seedsmen, it is considered advisable that Seed Testing Stations should adopt the simple formula:

$$\text{Grade} = \frac{\text{Purity} \times \text{germinating power}}{100}$$

The percentage of weed seeds can be determined by taking the total of all kinds when the percentage of each kind is less than 0.30 per cent. small seeds and 0.5 per cent. large seeds and in other cases by taking the separate percentage.

As regards the species to be considered as weeds, a questionnaire has

(1) Full report obtainable at His Majesty's Stationary Office, Adastral House, Kingsway, London W. C. 2. Price eleven shillings and six pence.

resulted in listing the following species as the most abundant in North and Central Europe and these consequently should always be named in future reports.

Sinapis arvensis, Chenopodium album, Plantago lanceolata, Rumex Acetosella, Daucus carota, Sheradia arvensis, Centaurea Cyanus, Stellaria media, Brunella vulgaris, Ranunculus sp., *Vicia* sp., *Galiumj* sp.

Others less common, and limited only to certain areas but of undoubted importance, *e. g.* Dodder(*Cuscuta* sp.) should most decidedly be included in the reports of these districts.

The question of extraneous plants is discussed in relation to Seed Importation Acts and the advisability of stating with precision the proportion of extraneous seeds (useful or weeds) estimated as present in appreciable quantities in a sample of seed.

A suggestion was made in the discussion following the paper that each county submit to the International Seed Testing Association a list of the noxious weeds in which it is specially interested.

Report of the Dodder Committee.

DEGEN, A. VON. Director, Royal Hungarian Seed Control Station, Budapest.

The report of investigations made by the dodder (*Cuscuta*) Committee appointed at the Copenhagen Congress with a view to the determination, at present only in Europe, of the bounds within which the dodder plant produces its noxious effects. A clear distinction is drawn between the large seeded dodder (*Cuscuta racemosa*) and that of the common dodder (*C. Trifolii*).

The importance of climatic conditions in connection with dodder production is evident, and the consequent danger attached to imported seeds infected with dodder. Immunity to dodder infection appears to be confined to low altitudes, and in higher altitudes in northern regions of Europe the plants fail to become acclimatized and disappear after a short period. According to the reports received from Switzerland, only the *C. Trifolii* is found on the north side of the Alps and the effect is injurious only when the rainfall is limited to 1000 mm. In wet years the damage is negligible. *C. racemosa* is scarce and *C. arvensis* has not been reported.

As regards the boundary of dodder growth reported in other countries, the connection between growth and rainfall is not yet clearly defined, and further investigations are proposed on these lines.

The Work of the Official Seed Testing Station for England and Wales.

EASTHAM, A. Chief Officer, Official Seed Testing Station, Cambridge (1).

The work of the Official Seed Testing Station for England and Wales is discussed under four headings :—

(1) Testing for trade purposes ; (2) testing for samples taken from li-

(1) Full report obtainable at His Majesty's Stationary Office, Adastral House, Kingsway, London W. C. 2. Price eleven shillings and six pence.

censed private Stations ; (3) testing for control samples taken by Inspectors in accordance with the regulations issued under the Seeds Act, 1920 (4) Investigation work.

Amongst other problems under investigation at the present time may be mentioned those concerned with : loss of vitality in seeds stored under varying conditions ; delayed germination with special reference to cereals ; hard seeds and the determination of their real value when present in leguminous seeds ; relation between germination of peas in the laboratory and in the field; germination of sainfoin (*Onobrychis sativa*), with special reference to broken growths ; plumular growths in grasses.

The Vitality of Buried Seeds.

GOSS, L. (Seed Testing Laboratory, Bureau of Plant Industry, U. S. Depart. of Agriculture). *Journal of Agricultural Research*, Vol. XXIX, No. 7, pp. 349-362, 2 figs. Washington, D. C., 1925.

The depth at which seeds are buried has little influence on the preservation of their vitality. Their power of germination, after burial, on the other hand varies according as it is a case of a cultivated plant or an indigenous weed. In the former case it is observed that the seeds, after being taken from the ground, no longer germinate whereas those of weeds survive for a longer period. Among the buried seeds of 107 species of the latter, 71 germinated after 1 year, 61 after 3, 68 after 6, 69 after 10, 50 after 16 and 51 after 20 years.

This investigation is of practical importance because it shows that the seeds of the majority of weeds do not perish when ploughed in, and that therefore the attempt to eliminate weeds in this way is useless ; this fact on the other hand, does not indicate that it is useless to bury weeds before they seed. The vitality of buried seeds ensures the covering of the country with vegetation. A. F.

Admixture of Annual Argentine Rye Grass Seed in English and Italian Rye Grass Seed.

ROGENHOFER, Dr. E. Italienisches Raygras und argentinischen Raygras *Oesterreichische landwirtschaftliche Marktzeitung*, No. 12, March 20, 1925, p. 2, Vienna.

When examining the seeds of Italian rye grass sent this year to the Confederacy's Institute for Plant-Culture and Seed-Selection (formerly : Station for Seed Testing) in Vienna, for valuation, admixtures of 30 to 35 % of annual Argentine rye grass were found in several samples. The author describes the seeds of Argentine rye grass as very similar to those of English rye grass, from which they can only be distinguished when carefully examined. The Argentine seed is somewhat smaller and flatter. An awn is scarcely ever to be found on the outer glumes, as the glumes are always very badly damaged by the processes of thrashing and cleaning. It is by these thrashed-off awns and by the form and the colour that the small seeds of Argentine rye grass may be distinguished from those of the

English variety. In doubtful cases, the occurrence of weed seeds almost always furnishes a clue to the origin of the variety of rye grass in question.

On account of its short life and small yield of fodder, which is much inferior to the Italian variety, and which only gives one crop, the author advises that this seed should not be used and requests all purchasers of grass seeds not to buy them without a guarantee of purity, and to insist on a public statement to this effect. H. K.

General Information.

Members of the International Seed Testing Association.

Honorary Members.

Prof. A. VOLKART, Zurick.
Sir Lawrence WEAVER, London.

Corresponding Members of the International Seed Testing Association.

Dr. Å. ÅKERMAN, Svalöf, Sweden.
Seed Commissioner G. H. CLARK, Ottawa, Canada.
State Agricultural Adviser A. ELOFSON, Upsaal, Sweden.
Professor NILSSON-EHLE, Åkarp, Sweden.
Professor W. JOAHNNSEN, Copenhagen, Denmark.
Professor E. LINDHARD, Lyngby, Denmark.
Dr. G. H. PETHYBRIDGE, London, England.
Professor R. G. STAPLEDON, Aberystwyth, North Wales.
Dr. F. G. STEBLER, Zürich, Switzerland.
Dr. L. WITTMACK, Berlin, Germany.

Seed Testing Stations.

Argentine.

Buenos Ayres: Laboratorio de Control y Análisis de Semillas, Calle Azopardo 900.

Austria.

Graz: Landwirtschaftlich-chemische Landes Versuchs- und Samenkontrollstation, Heinrichsstrasse 47.
Linz: Landwirtschaftlich-chemische Bundesversuchsanstalt, Promenade 55.
Wien: Bundesanstalt fur Pflanzenbau und Samenprüfung, 11-2, Lagerhausstrasse 174.

Belgium.

Louvain: Station de contrôle des semences, 4 Place de l'Université.

Bulgaria.

Plovdiv : Station d'essais agricole du rayon de Sadovo près de Plovdiv.
Roustchouk : Station d'essais agricole du rayon d'Obrastzov Tchiflik près de Roustchouk.
Sofia : Laboratoire de contrôle de semences, Institut d'Agriculture de la Faculté agronomique à Sofia.
Sofia : Station d'essais et de contrôle agricole, Section du contrôle de semences.

Canada.

Calgary : Seed Laboratory, Immigration Bldg., Albertà.
Ottawa : Seed Laboratory, 117 Vittoria St., Ontario.
Quebec City : Seed Laboratory, Carrell Block.
Toronto : Seed Laboratory, 36 Adelaide St. E., Ontario.
Winnipeg : Seed Laboratory, 175 Portage Ave. East Manitoba.

Czecho-Slovakia.

Brno : Moravky zemský výzkumný üstav zemedelský, Oddelěni pro kontrolu semen, Květná ulice 19.
Bratislava : Štátne výskumné ústavy zemedelské, Ustav pro kontrolu semen, Matùskova 934.
Kosice : Štátne výskumné ústavy zemedelské, Ustav pro kontrolu semen, Letná ulice.
Praha : Semenářska kontrolni stanice, Zemědělské Rady pro Cechy, Václavské nám 47.

Denmark.

Kobenhavn : Statsfrokontrøllen, Fjords Alle 15.

Egypt.

Giza : Seed Testing Station, Higher School of Agriculture.

Esthonia.

Tallinn (Reval) : Die estnische staatliche Samenkontrollstation, Kirikut, 4.

Finland.

Helsingfors : Valtion Siementarkastuslaitos, Punanotkonkatu 4.

France.

Paris : Station d'Essais de Semences, 4 Rue Platon.

Great Britain and Northern Ireland.

Belfast : Ireland : Seed Testing and Plant Disease Division, Queen's University.
Cambridge : Official Seed Testing Station, National Institute of Agricultural Botany, Huntingdon Road.
Midlothian, Scotland : Seed Testing and Registration Station, East Craigs, Corstorphine.

Holland.

Wageningen: Rijksproefstation voor Zaadcontrôle.

Hungary.

Budapest: Magy. Kir. Vetömagvizsgáló Allomás, II. Kis-Rókusutca 15.

Irish Free State.

Dublin (*Ath Cliath*): Seed Testing Station (Department of Lands and Agriculture), College of Science, Upper Merrion Street.

Japan.

Kurashiki: Das Ohara Institut für landwirtschaftliche Forschungen. Provinz Okayama.

Latvia.

Riga: Versuchs- und Kontrollstation der Landwirtschaftlichen Fakultät und der Lettländischen Universität, Pflanzenbau Kabinett.

Norway.

Åas: Statens Frökontrollanstalt.
Bergen: Statens landbrukskjemiscke Kontrollstasjon og Frökontrollanstalt, Nygaardsgaten 50.
Trondhjem: Statens landbrukskjemiske Kontrollstasjon og Frökontrollanstalt.

Poland.

Kraków: Zaklad rolniczy doświadczalny Uniwersytetu Jagiellónksiego, Lobzowska 24.
Lwow: Panstwowa Stacja botaniczno-rolnicza, Zyblikiewicza 40.
Poznan: Stacja doświadczalna Wielkopolskiej Izby Rolniczej, Dabrowskiego 17.
Torun: Stacja oceny nasion Pomorskiej, Izby Rolniczej, Szopena 22.
Warszawa: Stacja kontroli nasion, Krakowkię Przedmiescie 66.

Russia.

Leningrade: Station d'Essais de Semences, Jardin Botanique.
Moscou: Station de Contrôle des Semences de la Société d'Agriculture, Smolensky Boulevard 8.

Sweden.

Borås: Frökontrollanstalten.
Gävle: Frökontrollanstalten.
Halmstad: Frökontrollanstalten.
Härnósand: Frökontrollanstalten.
Jónkóping: Frökontrollanstalten.
Kalmar: Frökontrollanstalten.
Linkóping: Frökontrollanstalten.
Luleå: Frökontrollanstalten.

Lund: Frökontrollanstalten.
Molkom: Frökontrollanstalten.
Skara: Frökontrollanstalten.
Stocksund: Statens centrala Frökontrollanstalten.
Täng: Frökontrollanstalten.
Västerås: Frökontrollanstalten.
Urebro: Frökontrollanstalten.

Switzerland.

Lausanne: Station fédérale d'essais de semences, Mont Calme.
Oerlikon-Zürich: Schweizerische landwirtschaftliche Versuchsanstalt.

United States of North America.

Arizona: Seed Laboratory, Experiment Station, Tucson.
California: Seed Laboratory, State Department of Agriculture, Sacramento.
Colorado: Colorado Seed Laboratory, Colorado Agricultural Experiment Station, Fort Collins.
Connecticut: Seed Laboratory, Experiment Station, New Haven.
Delaware: Seed Laboratory, State Board of Agriculture, Dover.
Idaho: Seed Laboratory, State Capital, Boise.
Illinois: State of Illinois Department of Agriculture, Division of Seed Inspection, Springfield.
Indiana: Seed Laboratory, Experiment Station, Lafayette.
Iowa: Seed Laboratory, Iowa State College, Agricultural Experiment Station, Ames.
Kansas: Seed Laboratory, Experiment Station, Manhattan.
Kentucky: Kentucky Agricultural Experiment Station, University of Kentucky, Lexington.
Maine: Seed Laboratory, Experiment Station, Orono.
Maryland: Seed Laboratory, Experiment Station, College Park.
Massachusetts: Seed Laboratory, Experiment Station, Amherst.
Michigan: The Seed Laboratory of the State Department of Agriculture, Lansing.
Minnesota: Seed Laboratory, University Farm Experiment Station, St. Paul.
Missouri: Seed Laboratory, Experiment Station, Columbia.
Montana: Seed Laboratory, Experiment Station, Bozeman.
Nebraska: Seed Laboratory, Department of Agriculture, Lincoln.
New Hampshire: Seed Laboratory, Experiment Station, Durham.
New Jersey: State Seed Laboratory, New Jersey Agricultural Experiment Station, New Brunswick N. J.
New Mexico: Seed Laboratory, Experiment Station, State College.
New York: Seed Laboratory, New York Agricultural Experiment Station, Geneva N. Y.
North Carolina: Seed Laboratory, Department of Agriculture, Raleigh.
North Dakota: Seed Laboratory, Experiment Station, Agricultural College.
Ohio: Seed Laboratory, Department of Agriculture, Columbus.
Oklahoma: Seed Laboratory, Board of Agriculture, Oklahama City.
Oregon: Seed Laboratory, Experiment Station, Corvallis.

Pennsylvania: Seed Laboratory, Department of Agriculture, Harrisburg.
South Dakota: Seed Laboratory, Experiment Station, Brookings.
Tennessee: Seed Laboratory, Board of Agriculture, Nashville.
Texas: Seed Laboratory, State Board of Agriculture, Austin.
Utah: Seed Laboratory, State Crops and Pests Commission, Salt Lake City.
Vermont: Seed Laboratory, Experiment Station, Burlington.
Virginia: Seed Laboratory, Department of Agriculture, Richmond.
Washington: Seed Laboratory, Department of Agriculture, Olympia.
Washington D. C.: United States Department of Agriculture, Bureau of Plant Industry.
West Virginia: Seed Laboratory, Experiment Station, Department of Agriculture, Charleston.
Wisconsin: Department of Agriculture, Division of Seed and Weed Control, Madison.
Wyoming: Seed Laboratory, Experiment Station, Laramie.

The names of the countries are all stated in English and in the corresponding alphabetic order, whereas the names of cities and stations are as far as possible quoted in the original language, otherwise in the language used by the stations concerned in the correspondance with the Association.

Several countries, for instance Germany and Italy, are not placed in the list, as they have not yet joined the Association.

SPECIAL ACTIVITIES
OF THE BUREAU OF AGRICULTURAL SCIENCE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

ENQUIRY ON LOCUST CONTROL.

LOCUSTS IN 'IRAQ.

I.

GENERAL CONSIDERATIONS.

A good deal of information has been collected from time to time regarding the locusts of Upper'Iraq.

I cannot hope to add very much new information to that already existing, as all visits to Mosul by agricultural officials, including myself, have been paid at the same period of each year. Consequently, the study of locusts and their habits has been largely confined to the hatching and moulting period.

In 1923 I was enabled to get a better idea of the locust question for two reasons: (*a*) I had previous experience which made many aspects of the situation familiar to me; (*b*) my period of special duty at Mosul was a good deal longer than on the former two occasions.

THE LOCUSTS.

The annual outbreak of locusts during the early part of each year has been one of the chief obstacles to progress in the development of agriculture in Upper'Iraq.

I was deputed to investigate some means of control more economical and effective than those which have been hitherto employed.

The locust breeds over a very large area ; 3000 square miles would be a minimum estimate of the area in which it can be found.

Climatic conditions vary considerably between the extreme northerly and southerley points in which the locusts breed. This results in a good deal of difference between the dates of hatching of swarms, according as they are scattered over the country.

Locusts hatched south of Shergat are often flying while those north of Mosul are still in the moulting stages.

The locusts of Upper 'Iraq are indigenous. A migratory locust however visits this part of the country, coming from Nejd at intervals of from five to seven years. The locusts are yellow in colour, harmless to crops, and are very much liked by Arabs as an article of diet. Their local name is Nejdi.

Natural Enemies of Locusts.

The locust of Upper Iraq is fortunate in possessing few natural enemies, of which there are two only. One is encountered during the moulting stages and the other during the incubation period.

Sparrows, and a bird known locally as the Abu Sowaida, eat great numbers of locusts while they are passing through the moulting stages. Unfortunately for the agriculturist these are not in sufficient numbers to reduce the swarms to the extent required in order to ensure the immunity of crops from their ravages.

The other enemy, encountered during the incubation period, is cold weather. Thousand of eggs rot from this cause alone annually.

Bustards feed on the locust during the incubation period, but are in such small numbers that few locusts are destroyed by this means.

Egg Collection as a Method of Control.

A year would not be too long a time in which to investigate the possibilities of controlling the increase of locusts by this method.

The observations recorded under this heading are the results of a very brief enquiry.

Egg collecting is without doubt as efficient a method of control as can be employed at present, but it has disadvantages.

In Upper 'Iraq it is not possible to control more than the populated and incidentally the cultivated areas by this method.

Locusts prefer to deposit eggs in stony and undulating country, and favour barren land rather than areas covered with vegetation. On land of this nature it is their custom to breed thickly in very localised patches, but it constitutes no exception to the rule however, if they breed on land which is not of the above description.

Boys of twelve years of age can collect 2 ½ pounds of eggs each in three hours. To make the work attractive it would be necessary to pay six annas per 2 ½ pounds collected, and they would thus earn on an average one rupee per day.

I consider that money allotted for locust work should be spent on the collection of eggs, as I am certain that a better result is obtained by this method than by any other.

To work effectively a whole time organisation is required, which would endeavour to obtain a definite weight of eggs, gratis, according to the status of the Shaikh's concerned, before paying for quantities subsequently obtained.

Ploughing as a Method of Control.

To plough a breeding ground only is rarely sufficient to destroy the eggs turned up to the surface, and only when extremely cold weather is experienced afterwards is any appreciable result obtained.

Eggs can be collected from land after ploughing much more quickly and efficiently than by merely digging for them with a " fas ",

The type of plough and class of animal used locally at present,. are suitable to plough the land on which the majority of locusts deposit their eggs.

A good deal of land was ploughed after January this year (1923) in various districts, but where the eggs were not collected afterwards, hatching was as numerous as on land which was not touched.

Operations under this heading can of course only be employed in the vicinity of cultivated areas.

The locust which hatches far into the Jasirah will remain a difficult problem for many years, unless it can be attracted to breed nearer the populated districts. From my observations this year I am inclined to think this can be done to a very great extent.

Where it is possible to reduce the areas of the breeding grounds the control problem will be very much simpler.

Last year an extensive desert fire burned every scrap of vegetation on the plain between Makhmor and the Lesser-Zab.

This year quite 50 % of the locusts in existence hatched on this area, apparently for no other reason than that the land was clear of vegetation before they commenced laying eggs.

It might be well worth while therefore, to watch the area between Shergat and Ain Dibs next year and see whether quantities of locusts breed there, as this area has been completely burnt up.

An interesting feature observed this year was that several large swarms having escaped the fire, yet seemed to thrive in the neighbourhood of small Wadis, where they apparently subsisted on nothing but water for the last seven days of the hopper stage. Thus I think that their direction is always towards the river during the moulting stages, not, as is often supposed, because better herbage is obtainable, but because they require water.

The greatest difficulty and one that will always be experienced in operations against locusts, is to get local inhabitants interested in taking any steps whatsoever, unless their particular crops are threatened. This is particularly the case on the Right Bank, where people seem to regard any measures attempted against locusts as madness, providing that some chance remains in favour of their crops.

Looking at the case from their point of view, one sees that they are to a certain extent justified in showing a lack of interest in the problem (*a*) because there is always a chance that they will not suffer on account of locusts ; (*b*) if they do, prices of grain are so low that the question of providing grain for household purposes does not present many difficulties.

Many cultivators this year could not decide whether the cost of getting the grain in would leave any margin at all when the produce was marketed.

Conclusion.

I think it fairly safe to assume that all past efforts to control the pest, both before and since the occupation, can have had very little effect on the ultimate control of the locust.

Personally I believe that locusts will not increase in the absence of control measures, although more may appear in some years than in others.

Any form of direct attack upon hoppers should, I think, be discontinued as being both uneconomical and inefficient. At the present moment I do not think Government is justified in embark-

ing upon any scheme whatsoever, my reason being (*a*) that the cost of eradicating the locust of Upper 'Iraq would certainly incur too large a sum. (Always supposing one had sufficient inhabitants on which to spend the money). (*b*) The damage caused by locusts would represent but an infinitesimal portion of the sum required for their extermination.

II.

REPORT OF ANTI-LOCUST WORK DURING 1923.

I was deputed to go to Mosul on January 21, 1923, with the object of establishing a scheme for controlling the increase of locusts in the Mosul area.

Any schemes in the nature of former efforts to control locusts were decided to be economically impossible at the present time. The primary object therefore was to investigate the possibilities of new methods.

My first impression on arriving in the Mosul Liwa was the backward nature of winter crops. Thus I judged that if locusts appeared in ordinary numbers at their usual time depredations caused by them amongst crops were likely to be much heavier than usual.

Very heavy weather prevailed at the time of my arrival and one could seldom leave the beaten track until the end of February.

I wanted particularly to collect information regarding egg collecting, but by this time only a few days remained until the first hatching took place. It was therefore impossible to get sufficient data to be able to decide whether or not the adoption of this method would be justified.

A fairly comprehensive survey of the areas favoured by locusts as breeding grounds during the early part of March indicated that locusts were likely to be numerically superior to average years.

As the crops were so backward, it was therefore more necessary to get some scheme of control inaugurated to control the pest this year. The protection of standing crops only was especially important and I prefer to judge results obtained by that standard only. As far as the control of the pest is concerned, I consider results were of no value whatever.

The only possible means of control on the spot was the oil at Quiyarah, but as no funds had been sanctioned I could do nothing.

The divisional authorities expressed their surprise that I had no funds. The Mutasarrif was particularly anxious to get some scheme in force and representations made by him succeeded in a sum of Rs. 6000 being sanctioned to be spent on control measurse this year.

The divisional authorities at Mosul were anxious to distribute efforts over as wide an area as possible. The programme accordingly arranged was to engage five local Momurs for the month of April.

These were posted, one to each of the following districts: Tel-Afar, Tel Kaif, Mosul, Kara-Kosh, Shergat.

Shergat being the largest and most difficult district to control I remained in this area to conduct operations personally as far as possible. I was also able to arrange the supply of oil to other districts by being always within easy reach of Quiyarash.

Operations in each District.

Burning of swarms was commenced at Shergat on a large swarm situated close to the outskirts of cultivation on the Hawi Shergat. This swarm was completely destroyed and operations were then begun on the left bank of the river.

The extent to which this area was infested far exceeds anything previously met with by me. Operations were very successful however in keeping hoppers out of the crops until April 22nd.

After this date it became impossible to keep them out for two reasons, (*a*) because additional supplies of oil were needed and I had no more funds, (*b*) local cultivators ceased to give any further enthusiastic help, on the plea that they did not mind turning out for five days, but having worked fourteen with no apparent decrease on the advancing swarms, and crops showing no tendency to ripen, they concluded that it was no use continuing their efforts to save the crops. The subsequent damage to crops was extremely heavy, 15 to 20 acres of wheat and barley being eaten daily.

It being impossible to do anything further in this locality I commenced working on swarms in the Shura District.

The swarms here were comparatively small and manageable; at the end of April no crops had been attacked in this district.

Kara Kosh. — Hoppers in this area were very numerous despite the fact that 1600 pounds of eggs had been collected and destroyed during February. Swarms were farly concentrated around the village of Tawalna. These were burnt as they appeared.

I toured the district thoroughly on May 9th and 10th and found no locusts, nor had damage been done. The praise for this is entirely due to the efforts of the Mudir of Kara Kosh.

Tel Kaif. — Burning the swarms commenced on April 10th and by May 9th 80 % of the swarms had been killed.

Very little damage had been done and the help given by Government was much appreciated by the Christian community of this district.

Mosul. — Crops around Hammam Ali suffered very heavily. Locusts having bred in crops were a very difficulty proposition in this district, as to destroy the locusts meant destroying the crops.

The Momur in charge of this area remained north of Mosul for the whole month. He suceeded in keeping hoppers out of crops only in the very limited area in which he worked.

Tel Afar. — By reason of the inaccessibility of this district it was not possible to carry out a very extensive programme of work.

Only one consignment of oil was sent to Tel Afar as the cost of transport of one gallon of oil from Quiyarah was more that the cost price of the oil. Thus repeated appeal from the Quaimmocam for more oil had to be disregarded. Moreover, conditions are very similar to those of Shergat.

The population is scarce and very widely distributed and the locust breeds over large and inaccessible areas.

At the time I left Mosul, Rs. 3700 had been spent, of which Rs. 2320 had been spent on oil. The remainder was spent on transport and other small incidental expenses.

Conclusion.

This year's campaign has been sufficient to convince me of two things: (*a*) that direct attack on the locust cannot be made on a sufficiently large scale at the present moment to have any appreciable effect, because any amount of funds cannot make up for the small population; (*b*) that no more money should be spent on locusts unless a proper organisation is formed which would be in existence permanently.

However small such organisation might be, it would do infinitely more good than is possible by one individual who goes to Mosul for a short period each year.

It is possible to save a good deal of the crops each year by fighting

locusts in the hopper stages. It is doubtful however whether the amount of good done justifies the cost of carrying out these operations.

In dealing with the pest it is the extermination of locusts that should be aimed at, crops will then be saved as a natural corollary.

There is a tendency in Mosul to think that as long as Government spends money annually on locusts some good is being done. The question is debatable. I maintain that we have by our previous activities strengthened local opinion that danger only exists when locusts commence hatching.

Actually, danger is ever present, either in latent or active form and the only way of overcoming the apathetic interest shown by local villagers at present, is to continually instil this fact into them.

Thus if one was sufficiently optimistic one could foresee the day when the villagers would turn out and collect eggs during the winter months, with the same enthusiasm that they show when a huge swarm of locusts is within a few yards of their finest crop.

It seems fairly safe to assume that all past efforts have had no effect whatever on the ultimate control of the pest. Therefore, unless a comprehensive scheme, continued ever a number of years, can be sanctioned, I consider that in the best interests of all concerned the problem should be left entirely alone.

E. A. Kinch,
Agricultural Department, Baghdad, 'Irâq.

International Organisation for Locust Control.

In accordance with the resolution in Art. 3 of the Convention with regard to international organisation for locust control, passed in Rome, 31st October 1920, at the International Institute of Agriculture, a special agreement has been made with the countries of North-Equatorial Africa, with the same end in view and on the same date.

Referring to this Agreement the " Service de défense des cultures d'Algérie ", charged with collating investigations carried out in Morocco, Algeria, Tunis, Tripoli, Egypt, and French West Africa, is drawing up month by month, a map of the flights of locusts, of which it regularly transmits copies to the countries interested and also to the International Institute of Agriculture, which uses them for its own special documentation.

AGRICULTURAL INTELLIGENCE

AGRONOMY.

Soil Science.

See R. Part II. *Proceedings of the International Society of Soil Science*, Abstracts.

Fertilisers and Manures.

807. **Availability of Nitrogen in Organic Manures.**

ADINARAYANA, RAO K. *Journal of Madras Sdutents' Union*, Vol. XII, No. 12, pp. 443 446, tables 4. Coimbatore, 1924.

In order to ascertain the availability of nitrogenous plant food material in manurial substances used by the Indian cultivator, the author carried out experiments on oil cakes and green manures, the amounts of available ammonia, nitrates, and nitrites being estimated at the end of 4 weeks and 8 weeks, and comparison made with the controls.

The conclusions drawn were as follows:

Green Manures. The nitrogen derived from *Cassia auriculata* is not of immediate use to the crops, only 3.33 % of the nitrogen being available as nitrate after 8 weeks.

Pongamia glabra gave 14 % as nitrates, and *Calotropis gigantea* 28 % in the same period.

Oil Cakes. White Castor Cake gave 80 % of its nitrogen in the form of nitrates, Black Castor Cake 57 %, Neen Cake 57 %, and Pugnan Cake 50 %. Illupai Cake resisted all bacterial action during the eight weeks, probably owing to the presence of a poisonous glucoside. W. S. G.

808. **Preparation of Phosphoric Acid: Replacement of Sand by Potash Silicates in the Volatilization Process.**

ROSS, W. H., MEHRING, H. L. and JONES, R. M. (Bureau of Schools, Washington, D. C.). *Industrial and Engineering Chemistry*, Vol. 16, No. 6, pp. 563-566, June 1924.

The authors partly summarise preceding articles (1) relating to the industrial preparation of phosphoric acid by the volatilization process,

(1) ROSS, CARRUTHERS and MERZ, *Ind. Eng. Chemistry* 9, 26. 1917.
CARUTHERS and MERZ » » » 10, 35. 1918.
ROSS and CARRUTHERS » » » 5. 725. 1913.
ROSS, *Inter. Cong. Applied Chem.* 15. 217. 1912.

and make an interesting comparison between the experimental results obtained by this process, and the data theoretically obtained by an application of NERNST's theory to the calculation of the temperature for the decomposition of calcium phosphate.

It was found by experiment that if chemically pure tricalcium phosphate was heated to 1300°C., with or without the addition of silica, very little loss of phosphorus occurred either in an oxidising atmosphere or in one deprived of oxygen. When on the other hand the phosphate is mixed with $^1/_5$ of its weight of carbon in a reducing atmosphere at 1300°C., about 45 % of the phosphorus present in the mass is volatilized, at 1400°C. 96 %, and at 1550°C. decomposition may be said to be complete. By adding both sand and carbon to the phosphate a still more marked effect was obtained in the process of volatilization of the phosphorus. When the carbon silica-phosphate-carbon mixture contains three molecular equivalents of calcium to one of silica, at *1300°C*, 97 % of the phosphorus is volatilized. If the molecular equivalent of silica be increased up to one of calcium to one of silica, the percentage of volatilized phosphorus decreases.

From the theoretically calculated data, based on the various possible decomposition reactions of the phosphate, it is shown that *silicic acid cannot replace in any considerable quantity phosphoric acid at a lower temperature than 2300°C.*; that the phosphate, in the presence of silica and carbon, may be decomposed at between 1100 and 1300°C, and in the presence of carbon alone may be decomposed only at from 1300 and 1400°C.

From this comparison between the theoretic and experimental data which, as is seen, are entirely in agreement, the authors deduce that the volatilization of phosphorus by the carbon-silica-phophates-calcium mixture, at a temperature below 1300°C, is not due to the replacement of the phosphoric acid by a very small quantity of volatile silicic acid, but to a reaction, in the presence of silica, in which carbon takes part.

Now since the volatilization of phosphorus under these conditions does not depend directly on the acidity of the charge, the use of a potash silicate seemed possible. By replacing the silica in the charge with a potash silicate, the authors proposed, with a single operation, to volatilize the phosphorus and potash. This very interesting problem was thoroughly studied by the authors, who, in this note, give the data of numerous practical experiments made. When in the ordinary charge the silica is replaced by an equivalent quantity of potash shale, so that for a molecular equivalent of silica there are three equivalents of calcium, the authors observed that both the volatilization of the potash and that of the phosphorus begins at 1050°C and that at 1300°C more than 90 % of both are volatilized. Below 1300°C either the mass does not melt at all or merely a beginning of fusion is observed, when the charge contains less than 20 % of sand or shale and more than 25 % of carbon. By oxidation, in the presence of water, of the volatilized product a solution of potassium phosphate in phosphoric may be obtained.

L. M.

[808]

809. **Determination of Phosphoric Acid in Fertilisers.**

BRECKENRIDGE, J. E. *Industrial and Engineering Chemistry*, Vol. 16, No. 11, p. 1180, November 1924.

The volumetric method for determining phosphoric acid, which has given excellent results in the determinations made on natural phosphatic rocks, may, according to the author, be applied to any fertilising mixture containing acid phosphates, provided care is taken first to precipitate the sulphates by means of a solution of barium nitrate. As a proof of this, the author reports the results of some analysis made with the gravimetric and the volumetric methods, barium nitrate having been previously added. The results obtained by the two methods are perfectly concordant.

L. M.

810. **Phosphatic Manuring of Pastures in Western Australia.**

BARON-HAY, G. K. *Journal of Department of Agriculture. Western Australia*, Vol. II, Nº 1, pp. 51-64, tables 7, plates 7. Perth, 1925.

The experiments described were carried out in order to demonstrate the value of phosphatic top-dressing for pasture and to ascertain the most economical manure to apply.

Demonstrations were made in each district and on all types of soil, 13 being made in 1922-23 and 25 in 1923-1924. Five acre plots were selected in each case, 2 acres being top-dressed with 1 cwt. of superphosphate per acre, one acre, no manure (control), and 2 acres received 2 cwt. of superphosphate per acre. Superphosphate was selected as it is easily obtainable and supplies phosphoric acid more cheaply per unit than any other phosphatic manure, in Western Australia. The manure was sown with a drill or broadcasted.

The results obtained showed that: Top-dressing with a phosphatic manure greatly increases both yield and quality of pasture; the average yield was increased about 2 ½ times. One cwt. of superphosphate per acre was found to be more economical than 2 cwt. W. S. G.

811. **Residual Effect of Acid Phosphate and Rock Phosphate.**

BAKER, W. G. *Journal of the American Society of Agronomy*, Vol. 17, Nº 3, pp. 172-186; figs. 7, bibliography. Geneva, N. Y., 1925.

The author's experiments were carried out on Iowa (U. S. A.) soils in order to ascertain how long an application of phosphatic fertilisers will be of practical value to crops. An account is given of results obtained by other workers. Experiment Station reports, greenhouse tests and field experiments extending from 2 to 8 years were studied.

The residual effects of both acid phosphate and rock phosphate continued to be shown at the close of the tests.

The increases in yields from the acid phosphate were usually higher the first year than in later years. In the case of rock phosphate the gain was less the first year or two, after which it was about uniform to the close of the tests. Rich soils gave more and quicker response to rock phosphate applications than poorer soils.

Clover possessed a higher power to utilize phosphates than maize or small grains. Early growth, maturity and quality were increased.

High grade acid phosphate was more slowly available on clays than on silt loams or loams.

Larger residual effects were shown from acid phosphate on soil containing lime than on acid soils.

The rate of exhaustion of the phosphorus in 44 % acid phosphate was 12.3 % the first year, 8.9 % the second year and 7.1 % the third year, or a total of 28.3 % in three years. W. S. G.

812. **American Potash.**

TURRENTINE, J. W. (Bureau of Soils, Department of Agriculture, Washington, D. C. *Industrial and Engineering Chemistry*, Vol. 16, No. 11, pp. 1192-1193, November 1924.

The author after having discussed generally the potash industry in America, both during the war and after, states that, in order that this industry may develop on a solid economic basis, it will have to depend on other large industries. In other words, potash should not be obtained alone, but should always be obtained as a bye-product or together with bye-products. The present American production of potash, which is calculated at about 25,000 tons of K_2O annually, is entirely based on three large industries (cement, borax and alcohol) and constitutes a bye-product of these industries. Surveys have been completed of the three industries mentioned above and also of the blast furnace industry, which show a total tonnage there producible of 225,000 tons.

Such being the case, the author predicts that the quantity of potash obtained as a bye-product of the great industries will increase from year to year. America has also a second and practically inexhaustible source of potash in her minerals such as the greensand of New Jersey, the leucite of Wyoming, the alunite of Utah, etc. According to the author, the problem of extracting potash from these minerals by an economical process has nearly been solved. In this way attempts are now being made to combine the production of potash with the production of alumina (one of the principal constituents of many potash minerals), a product of great importance to the aluminium industry.

Moreover, from recent observations already recorded, it seems that in some parts of America there exist pure beds of potash salts.

The author concludes by saying that America could, therefore, in a short time, draw abundantly from these three large sources, the amount of potash necessary for agricultural purposes, thus being entirely independent of European production. L. M.

813. **The Utilization of Leucite as a Source of Alumina, Potash and Silica.**

BLANC, G. A. *Atti del Congresso Nazionale di Chimica Industriale*, Milan, 13-18 April, 1923.

In this article the author describes his special method for the treatment of leucite — double metasilicate of alumina and potash — a mineral

[812-813]

which is particularly abundant in the volcanic areas of central and southern Italy.

This method has been studied for the purpose not only of finding a practical way to extract potash from the leucite, but also to extract and utilize the alumina and silica.

The method proposed by BLANC consists in the following:

(1) The concentration of the leucitic substance by means of an improved system of magnetic separation, whereby, with no great expenditure of energy and but slight loss, the leucite can be concentrated to 95 %. The leucite thus separated (1) would have the following composition:

K_2O	18 %
Al_2O_3	23 %
$Si\ O_2$	55 %

(2) Treatment of granular leucite with strong mineral acids (hydrochloric, nitric or sulphuric. The treatment with hot solutions of hydrochloric acid has been particularly investigated by the author from the point of view of industrial application.

As final products of this treatment would be obtained: chloride of potash of a very high degree of purity (98-99%), aluminium hydrate which, containing only traces of iron, could after previous calcination be directly used for the production of metallic aluminium, and pure silica, which in view of its physical condition can find various important applications in industry. L. M.

814. **Potash from Cement Dust.**

FOX, E. J. and WHITHAKER, C. W. (Bureau of Soils, Washington). *Industrial and Engineering Chemistry*, Vol. 16, No. 10, pp. 1044-1046. October, 1924.

The authors give the results of studies made with the object of finding a suitable method of recovering potash from the dust present in the gases generated in cement furnaces. This dust consists mainly of relatively large solid, particles, which are detached from the furnace walls; and of minute particles of potash salts, which are there mingled in a highly diffused state.

Many difficulties were encountered in recovering potash from these dusts by means of the different wet processes. However, a dry process has been tried successfully, to separate from, or better still, to enrich these dusts with potash, by making use of compressed air.

The authors report the results of the experiments, carried out according to this method, by two large Americans firms (Riverside Portland Cement Company, and Security Cement Lime Company) from which they

(1) The author refers to the leucite obtained from the leucite beds of the volcano Roccoamonfina.

maintain that in the finest fractions there is twice as much potash, as in the original material.

In all the fractions of any given specimen, the potash content decreases in relation to the increasing size of the particles. Hence, it is a question of a phenomenon of superficies, that is to say, that potash, instead of being simply mixed, as was the case of the other materials constituting the dust, is disseminated over the surface of the particles, and further is regularly distributed over the whole surface. The enrichment obtained would thus be due to the increase of surface aggregates obtained with the finer fractions. S. M

815. **Increasing Ammonia Production with Improved Catalysts.**

LARSON, ALFRED T. (Fixed Nitrogen Research Laboratory, Washington, D. C.). *Industrial and Engineering Chemistry*, Vol. 16, No. 10, pp. 1102-1004, October 1924.

The author draws attention to the fact that whereas in the literature on the subject there are minute descriptions of the technical details of the various processes used for obtaining ammonia, by direct combination, in the presence of a catalyst, of nitrogen and hydrogen, there is little regarding the catalysing mass.

This note gives the results of some researches made in recent years in the Fixed Nitrogen Research Laboratory at Washington on this important question. In these investigations it was borne in mind what had already been proved for some time, at first scientifically and afterwards in practice. Thus, though a large number of metals were proposed by various experimentors (osmium, ruthenium, molebderum, uranium, cerium, manganese, iron, nickel, etc.), in the course of these experiments only iron was examined as a catalyst, alone or with the addition of a small quantity of other substances (oxides, hydroxides, alkaline salts and alkaline earths), called "promoters", which greatly increase its catalyptic properties. The author points out that not all "promoter" substances produce the same effect. During the experiments, the object of which was to determine the various effective values of these different substances, mixtures of two or more were also examined. It was found that none of the substances used alone, produces on the catalyptic properties of iron the effect produced by the mixtures of two or more of them, when properly chosen. In order to demonstrate the superiority of a compound promoter, the author gives the data of some laboratory experiments made on the same gaseous mass, under the same conditions, by using as a catalyst mass, in the first instance iron plus small quantities of aluminium oxide, and in the second case, iron plus small quantities of soda, potash, and thirdly, iron plus small quantities of a combination of aluminium oxide and potash.

The first time 8 % of ammonia was obtained
" second " 5 % " " " "
" third " 14 % " " " "

[815]

Combinations of caesium and aluminium, caesium and zirconium and potassium and zirconium also gave excellent results.

The author also points out the technical advantages following the use of a catalytic mass formed of iron plus a compound promoter. It is very important to be able to work at a lower temperature than that generally used in commercial practice ; 475°C, under certain conditions, gives excellent results, also 450°C. The activity of the catalyst at this temperature lasts much longer. Also the efficiency of the catalyst formed by iron containing a compound promoter remains high even when the pressure is increased, in contradistinction to the other catalysts ; it is possible even to work at 1500 atmospheres pressure without any appreciable loss of efficiency. Recent experiments have shown that at this pressure from 70 to 80 % of the reacting gases can be converted into ammonia by simply passing them through the catalyst.

To ensure a good yield in the preparation of ammonia by the catalytic process, iron alone being used, and at a low temperature, a more complete purification of the gaseous, hydrogen-nitrogen mixture is necessary, because the presence of traces of impurity greatly diminished the yield. Commercially this is a serious obstacle, for the purification of the gaseous mixture involves considerable expense. The author however has heard that recently a new method has been examined and proposed, the object of which is to obtain very pure gases, without any greater expense being incurred in practice. This would render it possible to utilize commercially this very active and highly efficient type of catalyst.

Finally the author observes that the preparation of this iron type of catalyst requires great accuracy. The various iron oxides may be used for the purpose ; the use of artificial magnetite however has given better results. In the preparation the promoter substance is accurately added to the iron oxide under pressure. The reduction process however is generally done not with pure hydrogen, but directly with the hydrogen-nitrogen mixture used for synthetizing the ammonia. L. M.

816. A Colorimetric Method for Determining Nitrate Nitrogen.

SCALES, F. M. and HARRISON, A. B. (Division of Soil Bacteriology, Bureau of Plant Industry, Washington). *Industrial and Engineering Chemistry*, Vol. 16, No. 6, pp. 571-572. June 1924.

The authors describe a new colorimetric method for determining nitrates. The reagent proposed (strychnine reduced for use in the presence of concentrated sulphuric acid) is very sensitive and the method may therefore be employed in determinations of biological solutions containing a very small quantity of nitrates. The presence of chlorides is no drawback. The interference of coloured extracts is practically eliminated, being able to operate in considerable dilutions.

Only in the presence of peptone can this method not be used. The proposed method is simple, rapid and easily carried out. The authors describe minutely the preparation of the reacting agent, which requires great accuracy. L. M.

817. **Pot and Field Experiments with Common Salt.**

BARNETTE R. M. *Journal of the American Society of Agronomy*, Vol. 17, pp. 125-129, table 3. Geneva, N. Y., 1925.

The value of common salt as a direct or indirect fertiliser, and the question of posible injury from fertiliser salts containing relatively large proportions of common salt is important. However, unless a great amount of information as to a given soil is available the results of the application of salt cannot be forecasted.

From the results of pot experiments it appears that salt has a slight stimulating influence when applied in amounts of 200-300 lb. per acre, but when applied at the rate of 600 to 800 lb. per acre there is a slight depressing influence on the crop.

The field tests showed that the effect of salt in general practice is uncertain, and depended on so may factors that results cannot be predicted.

The application of common salt under certain conditions may have a favourable influence, but would probably not pay for the cost of material and time required. W. S. G.

818. **The Effect of Manganese on the Growth and Y eld of Rice.**

JIMENEZ, A. L. *Philippine Agriculturist*, Vol. XIII, No. 7, pp. 299-303, bibliography. Los Baños, Laguna, 1924.

The author carried out a series of experiments with pot cultures of rice, in order to ascertain the effect of manganese compounds on this plant.

The conclusions drawn from the results obtained were as follows:

Manganese dioxide, sulphate and chloride at certain concentrations proved to be beneficial and increased both the yield of grain and straw. The optimum concentration varied with the manganese compounds. The lowest concentration of the sulphate was beneficial, whereas higher concentrations were harmful. The chloride in the concentration of 0.22 % manganese gave a decrease in grain, but an increase in straw. Manganese dioxide proved beneficial to growth and increased yield in all cases.

The addition of lime appeared to counteract any beneficial effect of manganese on rice, and to accentuate detrimental effects.

W. S. G.

819. **Manganese Chlorosis of Pine Apples, its Cause and Control.**

JOHNSON, O. M., *Hawaii Agricultural Experiment Station. Honolulu, Bulletin No.* 52, pp. 38, plates 4, bibl. Washington, D. C., 1924.

A review is given of former investigations on manganese. The chlorotic effect of higher concentration of manganese has generally been attributed to a "toxic", effect of the manganese; it was not shown that the effect was due to a deficiency of iron.

The author's investigations show that in the Hawaiian soils manganese is mainly present in the dioxide form, and that the soils are acid, and calcium carbonate is absent.

Nutrient solutions containing a normal amount of iron, manganese sulphate and manganese dioxide, caused strong chlorisis and severe depression in plant growth. This chlorisis was overcome when the leaves of the plant (rice) were dipped in a solution of iron salts, or the amount of iron in the nutrient solution was greatly increased.

Manganese chlorisis is quite distinct from lime chlorisis, due to calcium carbonate.

No evidence was found to show that manganese exerts any stimulating effect on plant growth.

The difference in solubility of ferrous and ferric iron affords an explanation of the manner in which manganese induces chlorisis. Manganese dioxide would keep the iron present oxidised to the less available, ferric form.

Solutions of iron salts were applied to the leaves of chloritic pineapple plants, and effected immediate cure of the "toxic effects" of manganese, and induced normal growth. The most economical and effective treatment appears to be that of spraying the plants with an approximate 6 % solution of iron sulphate. No injurious results were found even when an 8 % solution was applied in a fine spray on young plants. The solution should be applied as soon as any signs of yellowing appear.

W. S. G.

820. **Recent Progress in Insecticides and Fungicides.**

MACDONNELL, C. C. (Bureau of Chemistry, Washington, D. C.) *Industrial and Engineering Chemistry*, Vol. 16, No. 10 pp. 1007-1012, bibliography. October, 1924.

The author alludes to the great progress made in recent years in the insecticide and fungicide industry, and the fact that this industry has extended and become of the utmost importance to the economic prosperity of every country.

After having pointed out that both in the study and application of the various products in use, a great number of facts must be born in mind (climatic conditions, chemical composition of the product used, nature of the matter secreted by the plants, etc.), he reviews the more important insecticide and fungicide products to-day prepared industrially.

Insecticides: The various arsenical compounds (white arsenic, arseniate of lime, arseniate of lead, arseniate of magnesium, various mixtures of arsenical compounds) are described.

White arsenic or arsenolite is the most important raw material for the preparation of all insecticides having a basis of arsenic. All the progress which has recently been made in the preparation of arsenious acid, beginning with arsenolite, may be indirectly regarded as progress in the field of arsenical insecticides.

The author describes some among the numerous methods proposed for the preparation of the various arseniates and briefly summarises important investigations regarding the chemical, physical and insecticide

properties of such products and the compatibility or otherwise of certain combinations of insecticides and of insecticides and fungicides.

Reference is made in this connection to the oil emulsions prepared with heavy mineral oils, which have recently been greatly developed. Details are given of preparations containing substances furnished by certain plants, which may be called insecticides : among these preparations the most important are those containing nicotine. The so-called *nicotine powders* are formed of a finely ground mineral substance in which nicotine sulphate or free nicotine is incorporated. At first only kaolin was used in preparing these powders, afterwards numerous investigations and researches were made on the use of various other substances (quick and slack lime, carbonate of lime or magnesia, chalk, talc and kieselgur).

Some preparations formed from soaps containing nicotine have also been placed on the market. These products however have shown a strong tendancy to deteriorate (*e. g.* oil of nicotine).

Flowers of *Pyrethrum* also are much used in the preparation of insecticide powders. The author alludes to the numerous and interesting investigations made recently with a view to isolating the active principle contained in the species most commonly used (*Chrysanthemum cinerariaefolium*). Many insecticide powders to day are prepared by extracting flowers of *Pyrethrum* with the lightest fraction of the minerals oils in which the active part is soluble.

Derris elliptica also contains a typical constituent and its roots are used to day for preparing very active insecticide powders.

From the seeds of the *Delphinium Consolida* and from the roots of a Peruvian plant locally called " cube " or "barbasco ", insecticide powders are prepared which seem to promise very well for large scale application.

The author then alludes to some investigations on some organic compounds which possess insecticide qualities for certain species of aphides. Pyridine, picoline and commercial pyridine (containing high homologues of pyridine) have, as contact insecticides, very little value. The alkaloids, with the exception of nicotine, also mostly have a low toxicity. Dipiridile, which has recently been prepared from pyridine, seems on the other hand to possess a high efficacity. The author then speaks of some toxic gases much used on account of the insecticidal properties they possess. First among these is cited hydrocyanic hydric acid in the gaseous state. To-day the use of liquid hydrocyanic acid (easily vaporized) has quite replaced the old system of generating hydrocyanic acid from cyanide and sulphuric acid. Experiments have been made to try the insecticidal properties of hydrocyanic acid gas on various fruits, especially citrous fruits, and on cotton. The results were promising.

Very energetic action in the destruction of insects is exercised by the gases evolved from a mixture of ethyl acetate (2 volumes) and carbon tetrachloride are very destructive to insects. This mixture, which has been proposed as an insecticide recently, possesses the very important property of not being inflammable. It is very active, especially against insects which infest stored grain, and has the advantage of not leaving any

unpleasant taste or odour in the products subjected to the action of its vapours.

This new insecticide costs rather more than carbon disulphide, but, as it is easily applied, is not poisonous to man, nor inflammable, nor does it cause explosions, it is preferable to carbon disulphide in every case where the use of the latter may be dangerous.

Another gaseous insecticide which has proved very useful in the case of cereals, is chloropicrin, which has been largely tested in recent years.

Carbon disulphide has shown itself very active, experimentally, in the destruction of the larvae of the Japanese beetle, when placed in holes in the soil. This treatment however is not effective when the soil is wet.

The author terminates this review on insecticides by alluding to the various treatments for protecting wood from the attacks of termites and other insects. Among others, the hydrocyanic gas and volatile arsenical compound treatments are deserving of mention. Crude phenol and creosote are also to be recommended as poisonous substances of marked effect, when added to wood pulp during its manufacture.

Fungicides : the author then alludes to the use of copper and mercury compounds, sulphur, and calcium sulphide solutions. Among copper compounds is mentioned copper carbonate powder (basic carbonate) which has shown itself very effective against smut on wheat seed, but only slightly so against oat smut.

A new fungicide is copper soap powder, prepared with copper sulphate, resin soap and fish oil, which has given excellent results in practical applications, owing to its high fungicidal properties, which are equal, if not superior (on account of its easy application) to Bordeaux solution.

Another copper salt mentioned by the author on account of its promising results is acetate of copper and, especially, basic acetate. As regards mercury compounds, a large number of compounds of mercury (derived from phenol and products homologous to phenol) have been studied for treating seeds of Graminae and have generally shown themselves good fungicides.

As regards the fungicidal properties of sulphur, the author points out that, as is shown from numerous investigations, the toxic action is developed only in the presence of oxygen and water and is due to the formation of pentationic acid, produced by the oxydation and hydration of sulphur. This explains why precipitated sulphur and colloidal sulphur, in a state of fine subdivision, being therefore more easily oxydizable, are more effective than ground sulphur.

Allusion is made to investigations on the manufacture and use of solutions of polysulphides of calcium.

To render insecticide and fungicide powders efficacious, they must adhere well to the plants, for this purpose special adhesive substances are mixed with the various products. Among the substances used for this purpose slaked lime is important, and has been the subject of numerous investigations.

Whey and calcium hydrate have recently been proposed as substitutes for slaked lime.

In recent years the practice of using powders in the dry state has been replaced by that of dusting with moist powders, whenever, it is possible to do so, for the latter method is better and quicker.

Examples are given of applications of arseniate of lead and calcium, carried out in America on a large scale by the use of aeroplanes, in large plantations of catalpa and cotton, which have given very satisfactory results. The author terminates by alluding to some investigations on the electrification of the particles forming the insecticide powders, and especially the arseniates with separate particles should be charged with positive electricity so that they may be attracted by the electro-negative charge presented by the wet surface of the leaves. A strong adherence would thus be obtained. L. M.

821. **Some Chemical Problems of the Insecticide Industry.**

DICKENSON J. R. *Industrial and Engineering Chemistry*, Vol. 16, No. 10, pp. 1013-1015, October 1924.

The author shows that chemistry plays an important part in the insecticide industry, the principal points connected with chemical science in this industry being three in number : (*a*) the chemical composition of the material manufactured, (*b*) the cost of production, and (*c*) the efficiency of the product. In insecticide factories a continuous and accurate chemical control is necessary in order to obtain a homogeneous product which will always be of a definite composition. Further, it is necessary to prepare these substances in such a way that the product is not affected by time or weather.

Besides carrying out the chemical control, the chemist in this industry should also seek the most economical mode of preparation.

However, the use of a product of great efficiency and high cost may be more suitable than that of a less effective product of low cost. It is necessary to kill the largest number of insects or fungi with the minimum consumption of material and labour.

Also as regards a correct application, the aid of the chemist is necessary, for by his analytical researches he can help the entomologists and plant pathologists to determine the lethal doses for various species of insects and to interpret the various results obtained. Further, the chemist, by determining the residue found on the leaves and other parts of the plants at varying intervals of time, after the application, under various climatic conditions, in dry and wet weather, etc., is also enabled to supply the necessary data for ascertaining the best time for making the application.

L. M.

822. **The Determination of Free Calcium Hydroxide in Commercial Calcium Arsenate.**

SMITH, C. M. and HENDRICKS, S. B. (Insecticide and Fungicide Laboratory, Bureau of Chemistry, Washington, D. C. and Delta Laboratory, Bureau of

Entomology, Tallulah, La.). *Industrial and Engineering Chemistry*, Vol. 16, No. 9, pp. 950-951. September 1924.

The authors describe the analytic results obtained, by a new method, in the determination of free calcium hydrate in the presence of carbonate and various arsenates of calcium. The method proposed consists in treating the sample under examination with an excess of acidified alcohol of known value and then making the back titration by using a titrated solution of potash or caustic soda in alcohol.

Experiments were made with alcoholic solutions of hydrochloric acid, acetic acid and benzoic acid. The best results were obtained with benzoic acid, which was used by the authors in 0.1 N solution of 93 % ethyl alcohol. Phenolphthalein was used as an indicator, and for the back titration — during which, the liquid must be continually shaken — a solution of 0.1 N caustic soda in 93 % ethyl alcohol was used.

From the data drawn up it was shown that the method gave excellent results (approximation of 0.02 %) on a mixture of known composition.

The method is not so perfect in the presence of magnesium compounds. The authors, seeing that many of the commercial calcium arsenates contain considerable quantities of magnesium, are investigating a suitable modification of this method, in order to obtain reliable results also in the presence of magnesium. L. M.

Agricultural Botany, Chemistry and Physiology of Plants.

823. **Agricultural Ecology.**

GRAY W. S. *Agricultural Progress*, Vol. II, pp. 24-28, bibliography. London, 1925.

Agricultural meteorology, plant breeding and other allied sciences have been studied by many investigators, but a correlation of these studies is now required.

Agricultural ecology attempts to determine by the study of specific differences in growth and other characters, what varieties of cereals, etc., are suitable for cultivation under any given climatic or environmental conditions.

The limiting factors of a crop may be physical, chemical or biological, and the investigations of the meteorologist, chemist ad genetist may often form different phases of a larger problem, hence the importance of co-operation, and also of a central directive body to act as a clearing house for information.

The importance of breeding rust-resistant varieties of wheat is evident but because a wheat is resistant, it does not follow that such will be the case under other conditions. In the description of such a variety should be recorded the climatic and other conditions for which these qualities hold.

The problem requires the collection of data respecting rainfall, soil humidity, temperature, etc., also data relative to particular crops, for instance, times of sowing and harvesting; such knowledge is essential to the

plant breeder to enable him to obtain, or select the type most likely to succeed in a given environment.

The "critical periods" of a crop have special significance. By the term "critical period" is understood the interval during which the plant reaches the maximum sensibility to a given factor, and during which variations in the intensity of that factor will have the greatest effect on yield. The 20 days before heading constitute a critical period for wheat, in relation to humidity. If during that period the rainfall is less than the minimum needed for the normal development of the plant, the crop will be small, even if there is abundance of rain later on. The critical periods always coincide with certain phases of growth, during which certain climatic conditions are essential if development is to proceed at a maximum rate.

The influence, both of the time of application and the quantity of water has been shown by the experiments of Prof. AZZI at the Botanic Gardens of the University of Rome, on four varieties of wheat. KÖENIG has shown the existence of critical periods in the case of sugar cane, from data collected over a series of years from 27 stations in Mauritius.

It is not the absolute value of a meteorological factor that counts, but its distribution during the different stages of the growth period of the plant.

The yield of a crop is the result of a compromise between productivity and the degree of resistance to adverse environmental factors. At Svalöf, a hybrid wheat, Pansar, yielded 67 % more than the local wheat; this hybrid was grown at other stations farther north, and a point was reached where the temperature factor became important and the local type yielded more than Pansar, owing to the greater cold-resistance of the former.

Briefly, the aim of agricultural ecology is the determination of the climatic zones of wheat and other plants throughout the world, and the co-ordination and direction of research, the ultimate object being the possibility of stating definitely what crop, and what particular variety of the crop, is most suitable for any given climatic and evironmental condition.

To Prof. PIROTTA of the Accademia R. dei Lincei, Rome, and to Prof. AZZI is due the foundation at the R. Accademia, of the International Institute of Agricultural Ecology which has been recently established.

W. S. G.

824. **The Origin and Geographical Affinities of the Flora of California.**

LE ROY ABRAMS (Stanford University). *Ecology*, Vol. VI, N° 1, pp. 1-6. Brooklyn, N. Y., 1925.

The geographical distribution of plants is governed by the following laws: (1) Plants persist only when the environment is favourable to their growth and reproduction; (2) Different species of plants need different environments; not all plants thrive under the same temperature, moisture and soil conditions; (3) The individuals of a species, and in a wider sense the members of a genus, have common predecessors and a common place of origin, from which their descendents have migrated.

The author, having studied the flora of California, especially from this point of view, has come to the conclusion that the flora of lofty mountains

is of northern origin and composed of genera common to the northern part of North America and of Eurasia.

The flora of the deserts, on the other hand, is of Mexican origin. That of the 'cismontane' region, which is presumably the Californian type, is composed of both these elements with some other endemic and surviving forms. Such a region had an oceanic rather than a continental climate from the Cretaceous epoch, and the flora has therefore been less disturbed than in the eastern parts of the United States by the great climatic changes of the Tertiary epoch. Hence the surviving *Sequoia* and *Tumion* forms. The antiquity of the flora is also proved by its affinity with that of Southern Asia, the Mediterranean region and the antipodes. A. F.

825. **Relation between Structure and Chemical Nature of the Beetroot.**

COLIN, H. and GRANDSIRE, A. Structure et Chimisme dans la betterave, *C. R. de l'Académie des Sciences*, Vol. 180, No. 3, pp. 599-601. Paris, 1925.

The beetroot can be advantageously used for the separate study of the conducting tissue and the interstitial parenchyma. In fact a transverse section of the root of a beet shows clearly the separation of the different elements; in the centre a simple woody cord, around which are eccentric zones of bundles, separated one from the other by the parenchyma. As the veins in these roots have a clearly marked direction, it is possible to isolate in the pulp the parts containing woody bundles or those without any vascular elements, and thus to proceed to a separate analysis of the different elements. In this way it is possible to obtain an idea of the distribution of the substances, according to the constituent elements.

In the vascular tissue there is a large amount of dry substance, and consequently also of sugar, while on the other hand the mineral salts predominate in the parenchyma; in the latter the shortage of sugars is counterbalanced by the concentration of the electrolytes, so that, if the index of refraction is lower, the electric conducibility is higher in the parenchyma.

The content in organic nitrogen is much the same in the two elements (about 0.14 %), taking into consideration the percentage of hydration, the dry substance in the conjunctive tissue being richer in nitrogen than that in the vascular tissue.

The parenchyma contains about twice the quantity of reducing sugar as compared with the bundles and also a greater proportion of sucrose; the oxydising enzymes are however chiefly located in the bundles.

It is generally assumed that the reaction of the tissue of the liber is alkaline; the authors however have not been able to confirm this opinion and could only observe that in any case the vascular areas have the same reaction as the parenchyma, the P^H value being always nearly 6.

The observations of the authors therefore demonstrate that in the interior of a single root the chemical nature depends on the structure, however uniform is the osmotic pressure. This has a practical bearing on the analysis, which should be made on entire sections.

The experiments have been made on forage beets, on account of the difficulties which are found in taking samples of sugar beets, the latter being generally speaking, all veins. A. F.

826. **The Nitrogenous Metabolism of the Higher Plants.**

CHIBNALL A. C. (Biochemical Department, Imperial College of Science and Technology). *Biochemical Journal*, Vol. XVIII, N°. 2, pp. 336-407. Cambridge, 1924.

In this part of his work, which is a continuation of previous investigations, the author draws the following conclusions:

(1) During the night the protein content of bean leaves diminishes, in consequence of the breaking down of the cytoplasmic material. The products of this protein decomposition are removed from the leaf.

(2) The products of decomposition consist in great part of asparagine and other substances of undetermined composition containing free aminic nitrogen. It seems that the asparagine serves to transport the nitrogen from one part of the plant to another in a form adapted to the new synthesis.

(3) In certain conditions, not yet determined, the metabolism of the leaf nitrogen may undergo variations. In certain cases, in which no formation of asparagine was observed, there was no production of bean pods. A. F.

827. **Hydrocyanic Acid as a Toxic Agent to Plant Growth.**

HAWKINS R. S. *Journal of the American Society of Agronomy*, Vol. 17, N° 3, pp. 169-171. Geneva. N. Y. 1925.

The author's experiments were carried out on peas, barley, sorghum and vetch seedlings, grown in CRONE's nutrient solution, to which potassium cyanide was added in concentrations equivalent to 0.5 to 10 parts per million of hydrocyanic acid.

The cyanide has a marked effect on the roots of all the seedlings; secondary roots decreased in development with cyanide concentration, until with a concentration of 10 parts per million there were no secondary roots.

A cyanide concentration equivalent to 0.5 part per million HCN had a stimulating effect on barley, sorghum and vetch seedlings, but on peas has a depressing effect.

Hydrocyanic acid, if present in the soil solution at a concentration of 1 : 1000 000 would probably depress plant growth in most instances.

W. S. G.

228. **The Feeding Power of Plants in Different Soil Horizons.**

MILLAR, C. E. *Journal of American Society of Agronomy*, Vol. 17. N° 3. pp. 150-156, figs. 4 bibliography. Geneva, N. Y. 1925.

Difference of opinion exists regarding the relative unproductiveness of soil below the humus-bearing horizon, usually termed " subsoil ".

The growth of oats and inoculated sweet clover on different horizons of Fox sandy loam and Miami silt loam, indicate that different crops may have quite different feeding powers in the various soil horizons.

The small growth of sweet clover on the brown layer of maximum clay of the Fox soil, throws some doubt on the conclusion sometimes drawn from field observations that an accumulation of roots in a horizon of this type indicates a supply of available nutriments. W. S. G.

829. **Athmospheric Electric Currents, Normal and Abnormal, and their Relation on the Growth of Plants.**

BLACKMAN, V. H. *Quarterly Journal of the Royal Meteorological Society*, Vol. 50, No. 211, p. 197-207, figs. 2. London, 1924.

The effects of normal atmospheric electric currents have been firstly investigated by surrounding each pot plant with a steel-wire cage, so as to disperse the electric currents which could influence the plants. In this way it was possible to notice a small but constant diminution of the crops of the plants thus freed from the influence of electric currents.

When through the properly isolated wires an electric current at high voltage was sent, a larger crop was obtained. The intensity of the current, however, is of definite importance, as by currents of 10^{-10} amp. the crop was favourably affected, whilst by those of 10^{-8} it was diminuished. Furthermore, the results obtained were still better, if, instead of continually applying the current during the full period of the growth, it was limited to one month only, for instance the second. This shows that the growth of the plant and its crop are differently affected by the currents, which fact is proved by the increase in grain yield, which is much greater than the increase in total dry weight.

The effect produced by electrification, however, is out of all proportion to the energy furnished; therefore the physiological action of the currents must be considered as stimulating. Furthermore, it results from laboratory experiments that one of the physiological effects of the smallest electric discharges is to accelerate the rate of growth. A. F.

CROPS IN TEMPERATE AND TROPICAL COUNTRIES.

Cereals, Roots and Forage Crops.

830. **New Varieties of Wheat in Queensland.**

QUODLING, H. C. (Director of Agriculture, Queensland). *Queensland Agricultural Journal*, XXIII, No. 4, pp. 321-329, plates 10. Brisbane, 1925.

Thirteen new varieties of wheat, suitable for Queensland conditions, have been produced as the result of several years work of Mr. SOUTTER, the manager of the State Farm, at Roma.

In Queensland the rust problem transcends all others; the losses from rust have been very great on several occasions.

The names, and very brief particulars of the 13 varieties are given in the article. W. S. G.

831. **Varietal Experiments with Red Winter Wheats in Dry Areas of the Western United States.**

CLARK, J. A. and MARTIN, J. H. *United States Department of Agriculture Bulletin, No.* 1276, pp. 47 tables 26. Washington, 1925.

The average precipitation at 10 field stations in the Great Plains is between 14 and 23 inches per annum, and in the Great Basin area, between 7 and 14 inches.

Data regarding yield, height of plant, time of maturity, stem-rust, weight per bushel, are given for 110 varieties and strains of winter wheat. Samples of the more important varieties were milled and bread was made from the flour.

Three classes of winter wheat were compared : hard red winter, soft red winter, and white ; the hard red winter wheat consistently outyielded the other classes of winter wheat.

Strains of Kharkof were selected as the standard for comparison ; this wheat was found to be equal or slightly superior to Turkey, the leading variety of hard red winter wheat, in yield, winter hardiness, and in milling and baking quality.

Kanred was found to be the most productive hard red winter wheat for the Great Plains area. Other highly yielding strains are Alberta Red, Argentine, Beloglina, Blaskhull, Karmont, Montana No. 36, Nebraska No. 60, and Turkey (C. 1 No. 1571).

In winter hardiness Minturki, and in stem-rust resistance Kanred exceeded other varieties.

For milling and baking value Beloglina, Kanred, and Minturki have one or more advantages over Kharkof and other hard red winter wheats.

W. S. G.

832. **The Effect of Spacing on the Yield of Wheat.**

ENGLEDOW, F. L. (Plant Breeding Institute, Cambridge). *Journal of Agricultural Science*, Vol. XV, Part 2, pp. 125-144, tables II, figs. 3. London, 1925

Grain is an end-product of all the vital processus of a plant's life, hence, yield must reflect those processes. An analysis of yield would simplify the testing of new plant forms : the analysis should include the vital processes of the plant, the effects upon them of environmental factors and their relation to grain production. At present, such an analysis cannot be made ; only an algebraic analysis is practicable, the simplest form of which is : $Y = peng$, Where $Y =$ yield, $p =$ average number of plants per unit area, $e =$ average number of years per plant, $n =$ grains per ear, and $g =$ average weight of a single grain.

The first factor p is the key to the resolution of all, as, in general, e, n and g are dependent upon p. Any cereal varies in yield with different

inter-plant spacings, hence yield in field crops has great dependence on spacing.

Tests which merely give gross yields can afford no analytical information. No details are given of inter-form difference, which in plant-breeding it is desirable to know.

Tests fall into two chief categories, small scale and field tests. Field tests of cereals, drilled in the usual manner have the advantage of including the usual wide range of field spacings. They are capable of showing differences of 2-5 %. But they are subject to variations of weather, and of soils, hence repetitions in many places, and for several years are required. Also, yield testing on a field scale is often limited to sowing, harvesting and calculating; they are costly, non-analytical and unsuited to be the sole tests.

In assessing such a complex as yielding capacity, the chess-board plot test, the spacing plot, the field test, and the observation crop should all find a place. In deciding the relative importance of each of these, regard must be paid to convenience of working and expense.

W. S. G.

833. **Inheritance of Resistance to *Puccinia graminis* in Crosses between Varieties of Durum Wheat.**

HARRINGTON J. B. (University of Saskatchewan). *Scientific Agriculture*, Vol. V, No 9, pp. 265-288, tables, 9, plates 5, bibl. Ottawa, 1925.

The investigations were carried out to study inheritance of rust resistance in durum crosses, with reference to the study of the number, location, and nature of the genetic factors involved.

Hybrid families of two *Triticum durum* crosses were used, Kubanka No. 8 × Pentad, and Mindum × Pentad.

A study was made of the parasitic capabilities of four physiologic forms of *Puccinia graminis Tritici* on F_3, F_4, and F_5 progeny from crosses between three varieties of *Triticum durum* (Kubanka No. 8, Mindum and Pentad).

The four physiologic forms, 1, 17, 21 and 34 employed were consistent in their reaction on twelve varieties of wheat.

A total of 23 620 hybrid seedlings and 3 680 seedlings of parental varieties were inoculated. Pentad was resistant and Kubanka No. 8 slightly susceptible to form 34. Apparently Kubanka No. 8 and Pentad contain different factors for resistance.

In reaction to form 1, Mindum is very resistant and Pentad is slightly susceptible. The results obtained indicated the presence of two independently inherited factors, one dominant for immunity and present in Mindum, the other almost completely hypostatic to the first, but dominant for slight resistance, and carried by Pentad.

Mindum × Pentad hybrids were inoculated with form 34 in the F_3 and F_4 generations. Mindum is susceptible and Pentad resistant to this form. None of the 27 F_3 lines tested in F_4 proved to be like Mindum or Pentad. The results indicated the presence of more than one factor for resistance.

Mindum is susceptible and Pentad resistant to form 21. The results were similar to those obtained with form 34.

Reaction to rust was found to be inherited in the same manner as other characters.

No relation was found to exist between rust reaction and seed colour.

Experiments with Mindum × Pentad hybrids indicated the presence of more than one genetic-factor difference for each of the characters, rust reaction in the nursery, erectness of plant, height of plant, and earliness of heading.

There appeared to be a slight linkage between the inherited factors which govern resistance to rust in the field, plant height, erectness, and time of heading. Hybrids which resembled Pentad in rust reaction also tended to resemble Pentad in other characters. W. S. G.

834. **A New Variety of Oats.**

ZAVITZ, C. A. (Ontario Agricultural College, Guelph). *Scientific Agriculture*, Vol. V, No. 8, pp. 246-249. Ottawa, 1925.

A new variety of oats has been produced at the Ontario Agricultural College, Guelph, and has been named O. A. C. No. 144. This new variety has surpassed the O. A. C. 72 by an average annual yield in the College tests over a period of seven years. It was included in cooperative experiments with other varieties on 80 Ontario farms in 1923 and on 310 in 1924. The seed is not yet available in large quantities.

The O. A. C. No. 144 is a tall, broad-leaved, stiff-strawed, late variety, with a spreading head and a long, slightly brownish-white grain, almost free from awn, and gives a heavy yield of both grain and straw.

Application for registration of the new variety has been made to the Canadian Seed Growers' Association. W. S. G.

835. **The Origin of Maize.**

BLARINGHEM, L. Note sur l'origine du maïs. Métamorphose de l'Euchlaena en Zea. *Annales des sciences naturelles* : *Botanique*, Vol. VI, No. 3-4, pp. 245-263, 6 fig. Paris, 1924.

Maize is at yet unknown in the wild state. The author has for some time demonstrated the affinity existing between the wild species Euchlaena of Mexico, where it is known as "Teosinte" and maize, forseeing that a search for plants with closely grouped blossoms in the "Euchlaena", followed by repeated selection of plants showing extreme condensation of blossoms would lead to the production of maize. Such a metamorphosis would be indeed strange, because it would treat of a direct transition between two species.

The present study of the Author, made on samples harvested at Bento di Toledo, from the Institute of Agriculture of the State of St. Paul (Brazil) has shown that it is possible to follow the stages of a progressive metamorphosis from one plant to another. In the first place, there is a thickening of the axis which becomes fleshy and bears a large number of

series of ears. In addition the ears are arranged in pairs on a double row, while in Euchlaena they are placed singly. Finally, in the genus Zea, the ears unite and contain two flowers as in the transition state of the blossoming time. But in these latter the double ears with a single seed and one barren ear of the " maize " type, alternate with the independent double ears, some of which retain the characteristics of Euclaena.

This fusion leads to the supposition that this is a hybrid between the cultivated Zea and the true Euchlaena. Nevertheless it does not depreciate the value of the essential fact that a selection extending over some years might assist in the transformation of a blossom of the type Euchlaena into one of the type Zea. A. F.

836. **The Relation between Seed-Ear Characters and Productiveness in Maize.**

RICHEY, F. D. and WILLIER, J. G. *United States Department of Agriculture Bulletin No.* 1321, pp. 18, tables 10. Washington, D. C., 1925.

In the author's studies data were used from experiments extending from 9 to 14 years, with each of 4 varieties of maize includiug 3265 ears.

(1) Accidental variation in soil and experimental conditions were responsible for perhaps 90 % of the total variation in yield.

(2) From 2.5 to 6.7 % of the total variation in yield in the different varieties was a function of variation in the ear characters studied.

(3) Yield was found to be related positively to weight of ear and length of ear and negatively to number of rows and number of kernels per row in each ef the 4 varieties. Similarly yield was related positively to butt circumference and weight of cob and negatively to tip circumference in each of 3 varieties, the relations being reversed in the fourth variety.

(4) Selecting longer, heavier ears with proportionally heavy cobs and with relatively few rows of wide, thick kernels is warranted as a means of obtaining a supply of good seed for general planting. W. S. G.

837. **Improvement of Paddy Varieties.**

ILIFFE, R. O. (Economic Botanist, Department of Agriculture, Ceylon). *Tropical Agriculturist*, Vol. LXIV, No. 3, pp. 131-139. Peradeniya, 1925.

During the past five years work has been carried out at the Experiment Stations of Anuradhapura and Peradeniya, in order to isolate high-yielding pure lines of paddy from the mixtures generally cultivated by growers. The result has been that a number of strains have been obtained which are capable of giving yields greatly in excess of the average paddies. These strains are now being tested in various rice-growing districts, as certain strains appear to be suited to particular localities.

One of the most successful strains is that known as B-12, which formed one of 30 strains of variety No. 33. The grain characters of B-12 are : grain medium to large in size ; awnless ; colour, bright rusty yellow with slightly darker longitudinal streaks ; seed-coat, bright reddish brown;

endosperm, flinty with a trace of starch. At the Experiment Station the average yield of cleaned paddy for the last three years was 3618 lb. per acre and the average period of growth 181 days.

Most of the selected strains will be available during 1925 in quantities varying from 4 to 20 bushels. W. S. G.

838. **Variety Trials of Potatoes in England.**

University of Leeds, Bulletin No. 139, pp. 16, tables 8. Leeds, 1925.

The Bulletin gives an account of a series of tests carried out from 1920 to 1924 on varieties of potatoes, in order to study the respective yields and immunity or susceptibility to Wart Disease (*Synchytrium endobiotica*). The chief results obtained are summarised in the following table:

Average Yield of Ware Potatoes at Three Centres

(in tons per acre).

Variety		Osgodby	Bridlington	York	Number of years grown
Early:					
Dargill Early	(I)	9.7	7.287	5.2	4
Immune Ashleaf	(I)	7.45	7.262	9.825	3
Ally	(I)	12.85	10.65	11.45	3
Second Early:					
Great Scot	(I)	12.8	12.95	15.025	5
Arran Comrade	(I)	10.125	10.45	11.75	5
Main Crop:					
Tinwald Perfection	(I)	11.25	9.625	12.45	5
Kerr's Pink	(I)	14.05	11.787	13.85	5
Majestic	(I)	11.325	11.65	13.175	4
Bishop	(I)	9.3	9.337	10.087	3
Irish Chieftain	(I)	9.0	6.937	7.725	2
Rhoderick Dhu	(I)	5.6	5.5	9.55	2
Crusader	(I)	6.3	6.7	5.575	2
King Edward	(S)	9.15	9.3	9.5	2
Arran Chief	(S)	9.15	8.3	11.1	2
Up-to-Date	(S)	12.95	7.7	11.3	2

Immune varieties (I); susceptible varieties (S).

W. S. G.

839. **Edible Canna in Hawaii.**

Chung, H. L. and Ripperton, J. C. *Hawaii Agricultural Experiment Station Bulletin No.* 54, pp. 16, figs. 7. Washington, 1924.

The edible canna (*Canna edulis*) is indigenous to South America; the roots are cooked as a vegetable, but in Australia the plant is grown chiefly for starch.

series of ears. In addition the ears are arranged in pairs on a double row, while in Euchlaena they are placed singly. Finally, in the genus Zea, the ears unite and contain two flowers as in the transition state of the blossoming time. But in these latter the double ears with a single seed and one barren ear of the " maize " type, alternate with the independent double ears, some of which retain the characteristics of Euclaena.

This fusion leads to the supposition that this is a hybrid between the cultivated Zea and the true Euchlaena. Nevertheless it does not depreciate the value of the essential fact that a selection extending over some years might assist in the transformation of a blossom of the type Euchlaena into one of the type Zea. A. F.

836. **The Relation between Seed-Ear Characters and Productiveness in Maize.**

RICHEY, F. D. and WILLIER, J. G. *United States Department of Agriculture Bulletin No.* 1321, pp. 18, tables 10. Washington, D. C., 1925.

In the author's studies data were used from experiments extending from 9 to 14 years, with each of 4 varieties of maize includiug 3265 ears.

(1) Accidental variation in soil and experimental conditions were responsible for perhaps 90 % of the total variation in yield.

(2) From 2.5 to 6.7 % of the total variation in yield in the different varieties was a function of variation in the ear characters studied.

(3) Yield was found to be related positively to weight of ear and length of ear and negatively to number of rows and number of kernels per row in each ef the 4 varieties. Similarly yield was related positively to butt circumference and weight of cob and negatively to tip circumference in each of 3 varieties, the relations being reversed in the fourth variety.

(4) Selecting longer, heavier ears with proportionally heavy cobs and with relatively few rows of wide, thick kernels is warranted as a means of obtaining a supply of good seed for general planting. W. S. G.

837. **Improvement of Paddy Varieties.**

ILIFFE, R. O. (Economic Botanist, Department of Agriculture, Ceylon). *Tropical Agriculturist*, Vol. LXIV, No. 3, pp. 131-139. Peradeniya, 1925.

During the past five years work has been carried out at the Experiment Stations of Anuradhapura and Peradeniya, in order to isolate high-yielding pure lines of paddy from the mixtures generally cultivated by growers. The result has been that a number of strains have been obtained which are capable of giving yields greatly in excess of the average paddies. These strains are now being tested in various rice-growing districts, as certain strains appear to be suited to particular localities.

One of the most successful strains is that known as B-12, which formed one of 30 strains of variety No. 33. The grain characters of B-12 are : grain medium to large in size ; awnless ; colour, bright rusty yellow with slightly darker longitudinal streaks ; seed-coat, bright reddish brown;

endosperm, flinty with a trace of starch. At the Experiment Station the average yield of cleaned paddy for the last three years was 3618 lb. per acre and the average period of growth 181 days.

Most of the selected strains will be available during 1925 in quantities varying from 4 to 20 bushels. W. S. G.

838. **Variety Trials of Potatoes in England.**

University of Leeds, Bulletin No. 139, pp. 16, tables 8. Leeds, 1925.

The Bulletin gives an account of a series of tests carried out from 1920 to 1924 on varieties of potatoes, in order to study the respective yields and immunity or susceptibility to Wart Disease (*Synchytrium endobiotica*). The chief results obtained are summarised in the following table:

Average Yield of Ware Potatoes at Three Centres

(in tons per acre).

Variety		Osgodby	Bridlington	York	Number of years grown
Early:					
Dargill Early	(I)	9.7	7.287	5.2	4
Immune Ashleaf	(I)	7.45	7.262	9.825	3
Ally	(I)	12.85	10.65	11.45	3
Second Early:					
Great Scot	(I)	12.8	12.95	15.025	5
Arran Comrade	(I)	10.125	10.45	11.75	5
Main Crop:					
Tinwald Perfection	(I)	11.25	9.625	12.45	5
Kerr's Pink	(I)	14.05	11.787	13.85	5
Majestic	(I)	11.325	11.65	13.175	4
Bishop	(I)	9.3	9.337	10.087	3
Irish Chieftain	(I)	9.0	6.937	7.725	2
Rhoderick Dhu	(I)	5.6	5.5	9.55	2
Crusader	(I)	6.3	6.7	5.575	2
King Edward	(S)	9.15	9.3	9.5	2
Arran Chief	(S)	9.15	8.3	11.1	2
Up-to-Date	(S)	12.95	7.7	11.3	2

Immune varieties (I); susceptible varieties (S).

W. S. G.

839. **Edible Canna in Hawaii.**

Chung, H. L. and Ripperton, J. C. *Hawaii Agricultural Experiment Station Bulletin No.* 54, pp. 16, figs. 7. Washington, 1924.

The edible canna (*Canna edulis*) is indigenous to South America; the roots are cooked as a vegetable, but in Australia the plant is grown chiefly for starch.

Under Hawaiian conditions the edible canna can be grown at any season of the year; the maximum yield is produced at altitudes below 1500 feet. The crop is suitable for long or short rotation periods; the soil should be loose, loamy and well-drained. The plant is free from injurious insect attack, and from disease; the average yield is 18 to 20 tons of tubers per acre. The tubers have excellent keeping qualities.

The feeding qualities of both tubers and tops compare favourably with that of other starch and forage crops.

Canna starch has exceptionally large grains, morphologically similar to the potato; the viscosity is greater than that of maize starch but less than that of the potato. The cost of manufacture of the starch is low owing to the ease with which the starch separates.

The article gives details respecting climatic and soil requirements and methods of cultivation. W. S. G.

840. **The Time of Harvesting Soybeans for Hay and Seed.**

WILLARD C. J. *Journal of the American Society of Agronomy*. Vol. 17. No. 3. pp. 157-168, tables 3. Geneva, N. Y. 1925.

The yields of soybeans at different periods of maturity were obtained by harvesting at intervals of one week, eight uniformly distributed 16 foot rows of soybeans, grown on a uniform piece of land.

The greatest dry weight yield at one cutting is given when one-fourth of the leaves appear yellow, but cutting for hay at this stage causes difficulty in curing. The maximum green weight is given one or two weeks earlier.

The weight of leaves increases until the beans are well formed, remains constant for about three weeks, and then decreases. When the beans are well formed, the hay contains about 60 % leaves and 50 % when the beans are half grown.

The weight of stems reaches a maximum when the beans are well formed and then remains constant. The percentage of stems in the hay decreases until half leaves have dropped and then increases.

The yield of seed increases slowly at first, then very rapidly for one or two weeks, then more slowly until maturity. About 40 % of the mature crop is seed.

Soybeans should be cut for hay from the time the beans are well formed until the beans are half grown.

These conclusions apply to the varieties Manchu, Midwest, Ito San and Mammoth. W. S. G.

841. **The Belhambra (*Phytolacca dioica*) as a Fodder Plant.**

WALTERS, J. A. T. *Rhodesia Agricultural Journal*, Vol. XXII, No. 2, pp. 259-260, plates 2. Salisbury, Rhodesia, 1925.

The tree grows freely in Southern Rhodesia and produces seed abundantly. The plants can be grown easily from seed and when about 6 inches high should be transplanted to permanent sites. The growth

is rapid and plants should be spaced about 20 feet apart, to allow for growth of a spreading crown and corresponding root system. The branches will grow 12 feet in a single season.

Cattle will eat the stems of the tree when cut down ; the best method is to prune a few branches every day. The leaves form a good green food for poultry.

The belhambra provides a course of succulent food during dry months, and the nutritive ratio compares favorably with that of lucerne or green barley. W. S. G.

Tropical and Sub-Tropical Industrial Plants.

842. **Plant Textile Fibres produced in the British Empire.**

WARD, J. S. M. *Journal of the Textile Institute*, vol. XVI, No. 1, pp. 216. Manchester, 1925.

The article discusses, mainly from the economic standpoint, the production within the British Empire of : cotton, flax, jute, sisal (*Agave sisalana*), New Zealand hemp (*Phormium tenax*), sunn hemp (*Crotalaria juncea*), Deccan hemp (*Hibiscus cannabinus*), Mauritius hemp (*Furcrea gigantea*), kapok, and ramie. W. S. G.

843. **Inheritance and Inter-relationahip of the Principal Characters of the Flax Plant.**

DAVIN, A. G. and SEARLE, G. O. *Journal of the Textile Institute*, Vol. XVI, No. 3, pp. 61-82, figs. 8, tables 28. Manchester, 1925.

The article gives details and results of four years' research on the more important characters of the flax plant, from the point of view of fibre yield. The discussion is based for the most part on correlation data. It is shown that variations in flower colour, length of unbranched part of stem, percentage of fibre as measured by area in the cross-section of the stem, and the relative earliness of flowering, are all strongly inherited.

Other characteristics were studied and their inter-relationship investigated : these include number of capsules, number of seeds, thickness of stem, tillering, area of cross-section of stem, number and size of ultimate fibres, and number of fibres per square millimetre of stem area.

The differences between the nature and arrangement of various fibre bundles is clearly shown by excellent photomicrographic illustrations.

W. S. G.

844. **Cotton Grading.**

A. Grading of Cotton in the Sudan. *Empire Cotton Growing Review*, Vol. II, N° 2, pp. 117. London, 1925. B. Cotton Grading in South Africa. HESSE T. G. (Government Cotton Grader). *Ibidem*.pp. 117-121. C. Cotton Grading in Queensland. EVANS G. (C. I. E.). (Director of Cotton Culture), and GUDGE L. L. (Government Cotton Classer). *Ibidem*, pp. 121-128.

The article gives particulars respecting the schemes for cotton grading in force in the Sudan, South Africa and Queensland. In the case of

Queensland full details are supplied, including the schedule of grades and guarantees finally adopted for the 1924-1925 crop. W. S. G.

845. **Improvement of Queensland Cotton Seed.**

EVANS, G. (Director of Cotton Culture). *Queensland Agricultural Journal,* Vol. XXIII, Part. 3, pp. 183-184. Brisbane, 1925.

The cotton seed of Queensland is at present of mixed origin, but measures are being taken to place the industry on a more satisfactory basis.

The Department of Agriculture in 1920 decided to import seed of the Durango variety from the United States; this variety is of Mexican origin, where it is cultivated under dry conditions not unlike those of Queensland. There are now about 6000 acres under this variety and it is anticipated that in 1926 there will be sufficient Durango seed for Queensland requirements.

The quality of the lint is satisfactory and the average staple length is 1 3/16 in., a length which is in great demand.

The following varieties are being studied by the Department: Acala, Lone Star and Webber 49. W. S. G.

846. **The Effect of Water on the Cotton Plant.**

PRESCOTT, J. A. *Sultanic Agricultural Society, Bulletin* No. 14, pp. 63, figs. 20, Cairo, 1924.

The bulletin records in detail the results of an experiment carried out at Bahtim on the irrigation of cotton, with special reference to the effect of varying amounts of water on the plants. It was found that conditions favourable to vegetative growth such as abundant water supply, suitable temperature and abundant plant food, resulted in delayed flowering and eventually in a smaller yield.

Large excess of water causes variations in the normal curve, which appear to be due to shedding. W. S. G.

847. **Cotton Growing in Relation to Climate in Egypt and the Sudan.**

WILLIAMS, C. S. *Ministry of Agriculture, Egypt,* Bulletin No. 47, pp. 31, graphs 9. Cairo, 1924.

The report is a summary of climatic conditions in relation to cotton growing in Egypt and the Sudan and is meant chiefly as a basis for further work.

The greatest similarity of rainfall and temperature conditions in Egypt and the Sudan is found about a month before the picking of cotton begins.

Owing to the difference in the cotton season, the conditions of growth are similar and the growing cotton escapes the very hot weather in the Sudan and the winter in Egypt. The cotton actually matures at a lower temperature in the Sudan than in Egypt.

Relative humidity and evaporation vary greatly in different localities.

Cotton in the Sudan is probably grown with less daylight (sunrise to sunset) than in any other country as it is a winter crop farther away from the equator than any other winter grown cotton. W. S. G.

848. **Ratoon Cotton in Egypt.**

TEMPLETON, J. *Ministry of Agriculture, Egypt (Botanical Section)*, Bulletin No. 55, pp. 14, graph, bibl. Cairo, 1925.

The author mentions that the cotton plant was first cultivated in Egypt about 1821 and was grown as a perennial; also that it was on account of Government action alone that the perennial method of cultivation disappeared from Egypt.

The results of a preliminary experiment indicate that:

(1) Ratooned Plants (var. Sakellarides) in their second year give a higher yield that in the first;

(2) the quality of the second year's lint is not inferior to that of the first year;

(3) the crop matures much earlier in the second year;

(4) loss from boll-worm attack is less the second year;

(5) shedding of bolls, in proportion to flowers, is less in the second year. W. S. G.

849. **Cotton Growing in Madras.**

BARBER, Dr. C. A. (C. I. E.). *Empire Cotton Growing Review*, Vol. II, No. 2, pp. 100-107, 1 map. London, 1925.

The cotton area in the Madras Presidency extends from 8° to 16° north latitude, the area being broken up by two mountain ranges.

The indigenous cotton varieties are entirely rain-fed, the annual fall varying from 20 to 40 inches, the greater part falling from May to November, the remainder of the year often being quite dry. The growing period is in consequence limited, and the crop is only able to mature because of the peculiar qualities of the « black cotton soil », which covers large areas between the mountain ranges. This soil is very uniform in texture and is remarkably retentive of moisture.

The indigenous Indian cottons are deep rooting, and on this soil continue to grow and mature their bolls long after the last rains of the year have fallen.

In North India cotton is a summer crop, because of the winter cold, whereas in the south of Madras it is a winter crop; in the north of Madras a transition between the two extremes is met with. In the North, planting takes place in July and August, and in the South in October; in both cases picking begins in February, which in the South makes the growing period very short.

In Madras about 2,300,000 acres are under cotton each year. The species of cotton grown are, in the Western tract, *Gossypuim herbaceum*, with a rather short, harsh lint of a pure white colour; in the Northern area *G. herbaceum* and *G. indicum*, with a lint less white in colour but longer and softer, in the Cocondas tract a new species is grown, *G. obtusi-*

folium, with soft lint often of a khaki colour, irregular in length and inferior in staple to the Northern. In the southern part of Madras are grown *G. herbaceum*, *G. indicum*, and a recently introduced American species, *G. hirsutum*.

The preparation of a perfect seed bed is carefully attended to and the land is well cultivated, but no manure is given to the cotton crop because rank growth would be induced, which would prevent the bolls ripening before the hot, early summer, when all immature flowers and bolls are quickly shed. Any manure supplied is given to a previous crop of the rotation.

Except in the case of poor farmers, a rotation is universally practised in Madras cotton cultivation, a crop such as millet being introduced. On the black cotton soil weeding is not a serious item, but the land is continuously worked over after the rains have ceased. Picking is done by women and children.

The marketing leaves much to be desired, although improvements are being introduced by the Agricultural Department. The poorer cultivators who constitute the bulk of the growers, are always more or less in the hands of middlemen and moneylenders, which makes very difficult the introduction of co-operative selling, the establishment of regular markets, or the formation of buyers' associations.

Selection work has been carried out for many years the result of which is that there is at the present time a grade of superior cotton on the market, known as "Tinnevelly American" or "Pure Karunganni". The length of the lint is $\frac{9}{10}$ to 1 inch, and the ginning percentage 25 to 26, as against $\frac{3}{4}$ to $\frac{7}{8}$ inch and 27 for ordinary Tinevellies. An American Uplands type has been introduced which requires occasional irrigation, as it lacks the deep-rooting system of indigenous Indian cotton; this is termed "Cambodia" cotton, and is grown in the southern part of Madras. The length of lint is a little over 1 inch, the ginning percentage 33, and the market price obtained is equal to, or slightly higher than ordinary Uplands cotton.

W. S. G.

850. **The "Babassù".**

TEXEIRA DA FONSECA E. O Babassu (*Attalea speciosa* Mart., *Orbignia Martina* Barb. Rodr.) *Ministerio de Agricultura, Industria e Commercio, Serviço de Informações*, 45 pp. figs. & bibliography. Rio de Janeiro, 1924.

Before the war, the exportation figures for palm-nuts (including "petits-cocos", "piassava" and "babassù") were as follows:

Year	Kg	Value in reis	Value in sterling
1910	550 712	66:086	38 326
1911	394 728	47:368	28 019
1912	76 002	9:120	5 403
1913	485 019	58:202	34 490
1914	796 118	13:609	62 790

The following were the export figures under the head " coquilhos di piassava " :

Year	Kg.	Value in reis
1915	4 323 617	938:843
1916	2 560 516	878:783
1917	2 628 074	1 590:800

whereas, in the years following, the two products were kept distinct in the export statistics, as follows :

Year	Kg.	Value in reis
1918	6 103 773	4 320:938
1919	11 003 658	7 796:510
1920	6 581 944	4 598:832
1921	7282 885	4 688:007
1922	21 958 288	15 991:536
	Piassava nuts	
1918	205 633	82:016
1919	32 184	19:531
1920	90 070	12:312
1921	71 658	13:931
1922	728 285	206:097

Common names : These vary according to the different districts : in the Pianhy " coco de macaco ", in the interior of Bahia " coco de palmeira ", and near the Capital, " coco de rosario ", because the kernel is sold threaded in rings, in the Matto Grosso, " aguacù ", " auaçù ", " guaçù ", " baguaçu "," " guaguaçù ", which names are a corruption of " uauaçù " or " oanaçù " of the Amazons, which are the true native names (formed from ua — fruit, and acu — great, owing to the largeness of the fruit), " buassu " and " babassu " in Maranhâo.

Botanical classification : MARTIUS calls this tree *Attalea speciosa* and says it comes from Equatorial and Eastern Brazil, where it is called " uauassù " *propter fructos magnos.* PECKOLT gives it the same name, whereas in the Botanical Garden at Rio de Janeiro these specimens bear the name *Orbignia speciosa* Barb. R. In the publications (1917) of the Imperial Institute of London, the babassù is sometimes called *Attalea speciosa*, sometimes *Attalea funifera* : but under this latter name the " piassava " of Bahia is indicated. BARBOSA RODRIGUEZ says that the gen. *Attalea of* MARTIUS is an *Orbignia*, and has therefore changed its denomination into *Orbignia Martiana.* DRUDE calles this plant a *species incertae sedis.*

Geographical distribution : This palm is found diffused over all the region of the Amazons from the Matto Grosso to Bolivia, including Maranhâo, Pianhy, Rio Grande do Norte, Parahyba, Pernambuco, Goyaz, and its presence has been noted at Minas Geraes.

Products and by-products : The trunk is used as a support, and when it rots, forms an excellent fertiliser; the new leaves are used to cover huts, and to make walls and also hedges ; when dried they are used for making hats, nets, purses and baskets for carrying grain, the small ones, cut into narrow strips, serve for panniers and baskets; the tree, while still young, has a large and aromatic trunk ; the succulent substance of the mesocarp of a violet-white colour, rich in starch and tannin, is used as a food, after having been dried and washed, in the form of manioc flour. From this an oil is extracted similar to that of the " dende " (*Elaeis guineenses*).

The dark brown, horny, endocarp serves for making buttons.

According to the author the palm produces from 2 to 6 bunches of 2 and more m. in height and of varying weight ; the large ones with 500-600 nuts, the medium with 300-400, and the small with 200. Dr. A. DE ANDRADE says that the bunches weigh so heavy that two men can scarcely lift one ; 5 bunches examined by the learned Doctor bore respectively 580, 442, 361, 217 and 161 fruits.

As to the size of the fruits, some are 10-12 cm. in length and 6-8 in width, weighing 140-250 grams.

The following are the results of an analysis of the dried edible kernel made by Dr. ANDRADE :

water	13.200
fat	66.750
proteins	2.612
amino-acids, non-protein nitrogenous substances	0.875
saccharose and other carbohydrates	13.263
cellulose (fibre)	2.500
fixed mineral salts	0.780

The % of oil from hydraulic pressure was 69 % i. e. 690 gms., oil per 1000 gms. kernels.

An analysis made in London gave the following results :

water	4.21
oil	66.12
albumenoids	7.18
carbohydrates	14.47
mineral matter	2.02
fibre	5.99

The author then examines the various methods for extracting the oil, which is used for the manufacture of soap and perfumes, for lubrication and for the kitchen, etc. It is clear, unctuous and slightly yellow ; solidifies at 20-22°C. ; density 0.914. It makes an excellent fuel for motors of the Diesel and semi-Diesel type, superior to crude oil and the best petrol.

The following are the results of various analyses :

I — Analysis by the Imperial Institute, London:

melting point (in open tube)	26°C.
solidification point of the fatty acids	23°C.
specific weight at 15°C.	0.868
acidity index	5.5
saponification index	249
iodine index	15.6
non-saponifying substances	0.3%
soluble volatile acids	5.8
insoluble volatile acids	10.2

II — Analysis by R. Bolton and D. Hever (indication as *Attalea funifera*) :

weight of 100 fruits	11.200 gm.
% of oil in the kernel	65.7
melting point	22.2° C.
complete fusion point.	26.1° C.
solidification point	22.7°
saponification index.	246.9

III — Analysis by Dr. Brito Passos :

initial melting point:	72°F.
melting point:	79°F.
solidification point	72°F.
saponification value.	247.7
iodine index.	16.83
free fatty acids	1.98
refraction index (Zeiss scale at 40°C.)	36.9
glycerine.	13.2 %

There are many differences among these analyses, thus rendering necessary new and more exact researches

The following are two analyses of babassù copra and Bahia coconut copra, which show the superiority of the former :

	Babassù %	Bahia coconut %
moisture	4.21	3.80
oil	66.12	66.00
albumenoids	7.18	7.27
digestible carbohydrates	14.47	15.95
woody fibre	5.99	4.55
mineral matter	2.03	2.43
	100.00	100.00

The oil cake is very rich in food substances, especially albumenoids and carbohydrates, as is shown by the following figures :

water	15.59
oil	6.50
albumenoids	19.81
assimilable carbohydrates	4.00
fibre	16.50
mineral matter	5.60

Other by-products obtained by distillation from the "babassù" coconut are : superior metallurgic coke, tar, calcium acetate, and methyl alcohol.

It produces cocoa and vegetaline or butter, superior to that from milk The refuse forms an excellent fuel, which may be used for locomotives. The fibre is excellent for making cordage and ropes, and offers great resistence to sea-water.

Number of the trees : This is not easy to determine because in the statistics no distinction is made between coconut and other palms. The number (of the former) must be immense — several millions, the more so as those which are exploited are an insignificant part of the total number.

In a publication on the Principal Agricultural Products in Brazil in 1922-23, the production of "babassù" in 8 States (13 Municipalities) is given as 45 million kg., which at 600 reis per kg. = 27,000.000,000. reis. or Fcs. 86,557,500. According to the same work, the State of Maranhão from 1921 to 1923 produced 833,000 kg. of "babassù" kernels, and for 1923-24 its production was estimated at 2,260,000 kg. F. C.

851. **Variation in Coconuts with reference to Fruit Production.**

JACK, H. W. *The Malayan Agricultural Journal*, Vol. XIII, No 2, pp. 25, bibliography. Kuala Lumpur, 1925.

The selection of seed coconuts is of the greatest importance owing to the length of the profitable life of the palms, which under good conditions should exceed fifty years.

The wide variation in several characters of the palm is well known, but there is little statistical proof as to the degree of variation. These differences have been noted in the case of : number of roots per palm, number of female flowers per spathe, number of spathes, oil content of the meat, and in number shape, size and weight of fruits.

The author found that, despite environmental factors each tree will retain its own individuality as long as conditions favour a fair degree of development, and that good producing trees remain good yielders on the average, and poor yielders continue to give a low yield. The data given show definititely that there is a wide range of variation in fruit production per palm, and indicate that this is not due to soil variations.

The frequency curves show the variation in production graphically, and demonstrate the need for selection in this important branch of tropical agriculture. W. S. G.

852. **Resins and Oleo-Resins of Indo-China.**

CREVOST Ch. Résines et oléoresines de l'Indochine. *Bulletin économique de l'Indo-Chine.* Year XVIII, N° 170, pp. 1-57, numerous plates, 1925.

The *Bulletin économique de l'Indo-Chine* continues the publication of the *Catalogue of the Products of Indo-China*, which in the form of an abstract, constitutes an independent work of great documentary importance. The three first volumes of CREVOST and LEMARIÉ being completed, Mr. CREVOST, since the death of the latter, continues the publication alone,

The first part of Volume IV has been given in the *Bulletin Économique*, that is to say, class XVII " Resins and Oleo-resins ".

The author studies successively the following products :

A. *Resins.*

I. Dipterocarp-resins.

(1) Damars of Batavia : *Hopea odorata* Roxb., *H. Thorelli* Pierre, *H. dealbata* Hance, H. *Pierrei* Hance, H. *Recopei* Pierre, *H. ferrea* Pierre.

(2) Secondary resins : *Shorea vulgaris* Pierre, Sh. *Thorelli* Pierre, *Sh. obtusa* Wall., *Sh. Harmandii* Pierre, *Sh. hypochra* Hance, *Sh. Cochinchinensis* Pierre, *Sh. Henryana* Pierre, *Sh. maritima* Pierre, *Sh. cambodiana* Pierre, *Pentacme siamensis* Kurr. (=*Shorea siamensis* Mig.).

(3) Vatica Resins: *Vatica philastreana* Pierre, *V. Thorelli* Pierre, *V. harmandiana* Pierre, *V. astrotricha* Hance, *V. faginea* Dyer., *V. Dyera* Keng., *V. tonkinensis* A. Chev.

(4) Copals : *Anisoptera robusta* Pierre, *A. cochinchinensis* Pierre, *A. glabra* Kurz., *A.* sp.

II. Coniferous Resins, buds of *Pinus* spp.

III. Burseracees Resins, " elemi " of *Canarium copaliforum* A. Chev., black damar of *C. nigrum* Engl.

IV. Hamamalidagees Resins, of *Liquidambar tonkinensis* A. Chev., *L. Orientalis* Mill., *Altingia excelsea* Nor.

V. Leguminous resins, of *Sindora cochinchinensis* H. Baill.

VI. Hypericaceous resins of *Cratoxylon prunifolium* Dyer.

VII. Simaburaceous resins, *Ailantus malabarica* D. C., *A. fauveliana* Pierre.

VIII. Urticaceous Resins, *Strebius asper* Lour.

The direct exportation of Indo-Chinese resinous products is very small, but it must be borne in mind that the greater part of these products, such as the fine damars of Cambodia and Laos, pass through Siam for export, principally to Singapore, a large market for resinous products. The following figures show the importance of this market.

Trade of Singapore from 1900 to 1920.

(A) Copals :

Imports : 120,000 tons, valued at $ 26,500,000 or $ 221 per ton.

Exports : 144,000 tons, valued at $ 38,000,000 or $ 250 per ton, or a value of exports over imports of $ 12,500,000.

(B) Damars:

Imports: 96,000 tons, valued at $ 10,900,000 or $ 112,50 per ton.

Exports: 86,400 tons, valued at 11,700,000 or $135 per ton or a value of imports over exports of $ 800,000.

B = Oleo Resins (wood oils).

Supplied by *Dipterocarpus alatus* Roxb., *Dipterocarpus tuberculatus Roxb.*, *D. intricatus* Dyer, *D. Jourdaiini*, *D. artocarpifolius* Pierre, *D. Dyeri* Pierre, D. *Duperreanus* Pierre, *D. insularis* Hance, *D. obtusifolius* Teysm. *D. punctulatus* Pierre, *D. tonkinensis* A. Chev. *D.* spp.

The wood oils produced by these Dipterocarps are used almost entirely for local purposes,

Laboratory tests have shown that their distillation gives a large percentage of essential oil, average 65 %, which could undoubtedly be used in the preparation of paints when mixed with linseed-oil.

The author places the exudation of the *Calophyllum inophyllim* Lin. of the Guttifer family in the same class as these resinous products.

P. C.

853. **The Beet Crop in Czechoslovakia in 1924.**

URBAN, J. (Forschungs-Institut der tchsl. Zuckerindustrie). Das Wachstum der Rübe in Jahre 1924. *Zeitschrift für die Zuckerindustrie der Tchechoslowakischen Republik*, Vol. XLIX, No. 25, pp. 187-193, 2 diagrams. Prague, 1925.

The author compares the crop of beet in 1924 with that of 1923, taking into account all the elements of the beet (weight of leaves, roots, sugar content, etc.) as well as the weather conditions. Up to the month of September no differences were noticed between the two years; afterwards the growth increased in 1924, owing to more abundant rain. The total rainfall was in fact 378.5 mm. in 1924 from the 1st April to the 29th September against 302.4 in 1925. Consequently the average weight of the beetroot up to the 29th September was increased from 729 to 837 gm. On the contrary the sugar content decreased from 18.77 to 17.23 %, improving however in the following month of October in which fine weather was favourable to assimilation. An evident increase also took place in the foliage. On the whole, it resulted that in the last two weeks, the weight of root was 14.2 % higher in 1924 and the amount of sugar in each root was 6.44 % greater than in 1923. These two figures therefore show an increased crop per hectare. A. F.

854. **Coffee Planting in Tanganyiks Territory.**

FOSCANER, J. *The Spice Mill*, Vol. XLVIII, No. 1, pp. 22-27. New York, 1925.

The author's article indicates that in a few years the Arusha district of Tanganyika Territory will become a good coffee-producing area.

The Arusha district is situated on the slopes of Mount Meru, at an elevation of 3000 to 5000 feet. The climate is excellent; the long rains

occur from March to May, and the short rains in September, the total precipitation being about 55 inches. The soil is exceedingly fertile, and water abundant.

The first coffee seed came from Bourbon and Java. Bushes are planted 8-9 feet apart.

A report on a sample of coffee from the district states that it can be placed in the same class as the washed, hard bean of Costa Rica and Guatemala, and that the liquor has good body and flavour.

W. S. G.

855. **Tea in Ceylon.**

HARLER C. R. *Journal of the Indian Tea Association*, Part IV, pp. 193-226, Year 1924. Calcutta, 1925.

The author gives an interesting and instructive account of tea-planting in Ceylon, and treats the subject under the following heads:

Statisticas, climate, soils, planting, pruning, plucking, manuring, cultivation, pests and diseases, manufacturing process.

The article concludes with a comparison of India, Ceylon, and Japan teas.

W. S. G.

856. **The Effect of Distancing on Tobacco Leaf.**

IMATONG S. B. *Philippine Agriculturist*, Vol. XIII, N° 7, pp. 269-297, figs. 5, bibliography. Los Baños, Laguna, 1924.

The author found from his investigations that the different varieties of tobacco seem to require different distancing. The height of the plant is affected by the distance of planting. The size of the leaf is also affected; when planted 40 × 40 cm. and 40 × 50 cm. many small leaves were produced, but when spaced 50 × 75 cm. or 100 × 100 cm. the leaves were larger. The greatest weight in kilograms of lower standard and top leaves per hectare were obtained by close planting, but the size of leaves obtained by close planting was much reduced.

The burning quality of the leaves was improved by close planting, due perhaps to the leaves being thin and small veined, whereas wide spaced plants yielded leaves with coarse veins and a gummy tecture, which had poor burning quality.

W. S. G.

Arboriculture and Forestry.

857. **Fruit Growing in British Columbia.**

DYMOND T. S. *Agricultural Progress*, Vol. II, pp. 48-50. London, 1925,

Eighty per cent. of the orchard fruit in British Columbia is produced in the Okanagan Valley, where 20 000 acres of orchard are under cultivation. The valley is situated 150 miles from the Pacific coast at an altitude of 200 feet, in the dry belt, the rainfall being below 14 inches and irrigation is necessary. In the valley is the Okanagan Lake, 70 miles in length, on the shores of which the temperature rarely falls below 0° F., or rises above 90° F.

The chief centre is Kalowna, about halfway down the lake, situated on an alluvial flat; a series of benches, the alluvial flats of former lake levels rise behind the town; these flats are covered with orchards of apples, pears, peaches, plums, apricots and cherries.

The soil is ideal for fruit culture; ploughing in of vetches seems to be the only form of manuring required. The limiting factor is the water supply, and no more land can be brought under cultivation without fresh expenditure on irrigation works, which present fruit prices would not justify.

The fruit is mostly consumed in the prairie cities, while some is exported from Vancouver and through the Panama Canal to England.

The Federal Government gives grants in aid of farm costings and supports an experimental station, where experiments are carried out on matters of direct importance to fruit growers. A staff of horticultural, entomological and other experts give lectures and pay advisory visits. The University Agricultural Department gives courses of instruction at Vancouver.

As regards settlers: the Okanagan Valley is no longer open for the man without capital, as all the land than can, for the present, be irrigated is already developed. W. S. G.

858. **Investigations on Apples with Special Reference to Cider Apples.**

I. — CHEVALIER, A. (Chef de la Mission permanente d'agriculture au Ministère des Colonies). Recherches biologiques sur les Pommiers et spécialement sur les pommiers à cidre. *Revue de Botanique appliquée et d'agriculture coloniale*, Vol. 1, No. 3, pp. 149-115. Paris, 1921.

II. — SOURDIN. Composition des vergers des principales régions cidricoles. *Comptes rendus des travaux de la semaine nationale du cidre*. Paris, May 1925, pp. 83-90.

LIÈVRE A. L'élevage rationnel du Pommier. *do.* Paris, 1924, pp. 24-32.

LECŒUR. La création et l'entretien des Vergers. *do.*, pp. 32-43.

III. — BIJHOUVER J. (Laboratorium voor Plantenphysiologische Onderzoek). The Periodicity of the Development of the Bud on the Apple-tree. De Periodiciteit van ve Knopontwikkeling bij den Appel. *Mededeelingen van de Landbouwhoogeschool*, Vol. 27, No. 7, p. 63, fig. 10, 3 diagrams. Wageningen, 1924.

IV, — MANARESI A. and G. B. GARAGNANI. (R. Istituto Agrario Superiore di Bologna). The Floral Biology of the Apple. Ricerche sulla biologia florale del melo. *Le Stazioni Sperimentali agrarie italiane*, Vol, LVIII, Part 1 to 6, pp. 18-124, 62 tables, 5 plates, bibliography. Modena, 1925.

I. Normandy is at the present time the most important apple growing district in the whole world; the crop is devoted almost exclusively to cider making in France. Three Departments use the entire crop for the well known drink and during the years when the yield was exceptionally high (*e. g.* 1895), as much as 25 600 000 hectolitres of cider was produced. During the last 30 years, the greatest progress as regards apple growing has been made in the United States and in Canada. To France is due,

however, the credit of having been one of the first countries, to undertake a methodical study of improved fruit growing. At Rouen the first really scientific studies were made on the cider-press fruits and as far back as 1836 by the "Société d'Horticulture de la Seine-Inférieure".

The author with reference to the information supplied by the abbé ROSIER and A. LEBAULT states that the cider industry has made rapid strides in France since the end of the XI century and it is evident therefore that the cultivation of the cider apple did not originate from wild stock. In fact it is very obvious that the cultivated trees in the north-west of France differ considerably from the wild *Malus silvestris* found in the forests in the same region. The cider apples and dessert apples both belong to the *Malus domestica* groups and both may be traced as descended chiefly from *Malus dasyphylla* native of Western Asia.

All the cider apples in Normandy differ widely from the bitter fruits in the forests and the author is convinced that they originate from another region, namely the Biscay coastal area, in Northern Spain; where large numbers are still to be found.

The author has made a list of varieties and strains of *Malus* found growing wild in various parts of the world; he enumerates 32, drawing attention however to the fact that the term "species" is very loosely used in the case of apples.

The dying out of former varieties especially in Normandy, is admitted by the majority of fruit growers; propagation by grafting does not always give characteristic stock, and eventually variations in shoots occur which alter considerably the original variety. In addition to this, grafting may give rise to fairly distinct modifications, especially when the stock and scion are unsuitable. For this reason it is essential that the superior varieties be renovated or seed obtained; selection is consequently necessary if the variety better adapted for cider purposes is to be maintained.

Considerable progress has been made as the result of cross-fertilisation tests by KNIGHT in England and V. MACOUN in Canada.

The author supports the conclusions arrived at by NAITE as to the important part played by insects in cross-fertilisation of apples and pears.

Parthenocarpic varieties of apples are to be found.

With certain dessert varieties this is incomplete. In Russia and Norway certain varieties (Russian) grow satisfactorily as far north as 66°; in Canada not beyond 55°. In warm countries less success has been obtained; this may be attributed to the fact that attempts have been made to introduce superior cultivated varieties into Europe, when it would have been better to experiment with wild varieties already cultivated in the Mediterranean coast and in subtropical Asia.

The acclimatisation of apple trees to tropical countries is however, according to the author, not hopeless, and it is suggested that microcarpic apples be introduced from China and Japan and crossed with common varieties, and the hybrid obtained recrossed with the wild varieties in Indo-China (*M. laosensis* and *M. Doumeri*). In this way good results might be obtained.

In the list of species given, the author includes several Eriobotrya, in

particular, *M. bangalensis* Hook F., found occasionally at 1000 m. altitude; several Photinia in Indo-China, e. g. *P. Benthamiana* Maxim., found on the Annamite ridge at 1000 to 1500 m.; *Sorbus* spp. *e. g. Aria, Cucuparia, Micromeles*, in India, Yunnam and doubtless also on the unexplored mountains of Tonkin; the *Docynia*, the *Raphiolepis indica* Sindl., found in Cambodia at 600 m.; the Strauvraesin and Pourchinea of China; the *Amelanchiei* of America. If for example one or more of these species can be utilised as stock for grafting apples and if success is forthcoming in the tropical plains, the problem of acclimatisation will be well on the way to solution.

The following conclusions have been drawn by the author:

There is still much to be discovered as regards the biological peculiarities of fruit trees and especially cider apples, which are so abundant in Normandy and the surrounding provinces; until now cultivation and improvement have been undertaken only by unscientific methods.

The satisfactory results obtained, however, by investigators, suggests that considerable improvement may be possible both as regards selection and cultivation. To obtain a good crop, certain biological characteristics, brought to the fore during this work should be noted, and the conditions required to obtain better varieties.

The method of cultivation of fruit trees in the different cider provinces of France has been extraordinarily neglected. After reading the " Cahiers du Sire Gillies de Gonherville " it is surprising to learn that a simple country gentleman even as long ago as 1560 gave the greatest care to the raising of his apple trees and the manufacture of cider which was up to the standard of the present day Norman growers with their orchards and cellars.

When adequate attention is given to careful cultivation, and to the substitution of unsatisfactory varieties by good croppers, the cider industry will add considerably to its value and importance.

II. The essential qualities to be looked for in cider apples relate both to the tree and the fruit. As regards the tree the first requisite is fertility: as there is no variety that is equally fertile all the time, it is necessary in order to estimate production to take it over a period of at least ten years. An apple-tree may be considered as fertile which bears on an average, yearly, the third part of a full crop, i. e. a hectolitre and a half of apples. Among other qualities are vigour, to be recognized by the thickness and and the colouring of the foliage, hardiness, by which is understood resistance to atmospheric influences, attacks of insects and parasitic diseases, and adaptability to the soil; a closer study is necessary to establish practical conclusions as to this last point.

As regards the fruit, preference has to be given to varieties which have a good appearance for the market and which stand transport well; the juice should be easy to extract and should contain the right proportion of sugar, of acid and of pectic substances and generally the constituents favourable to the production of a wholesome cider.

There are at the present time about 100,000 varieties of apple-trees.

Among these a twentieth will be selected of which two twentieths should have acid fruits, six-twentieths of bitter fruit and twelve-twentieths of sweet fruit. So as to facilitate mixing, varieties will be cultivated which ripen at different seasons, selecting three-twentieths of trees in their first fruiting, seven-twentieths of those in their second and ten-twentieths in their third.

It is obvious that the varities must be adapted to the different soils and countries.

The most suitable soils are the flint clay soils, the least suitable the lime soils. Granite soils are excellent: and in soils containing potash large and well-developed fruit is obtained, which give a first rate cider.

Propagation is by seed, followed by grafting on the foot or better on the foot and at the top.

Of the utmost importance is scientific manuring which secures a regular crop. A full grown tree requires the following fertilisers for every square metre of the area covered by its roots:

Nitrogen 17 gm.; phosphoric anhydride 5 gm.; potash 22 gm.; lime 40 gm.

It should be taken into account that each apple tree produces annually 8 kg. of wood, 15 of leaves and 100 of fruit: hence the necessity for providing a sufficient quantity of material in the form of chemical fertiliser, road scrapings, calcareous marl, calcium carbonate, and decomposed stable-manure.

As regards growing crops on the soil under the trees, it should be noted that this should not be done during the first ten years of the life of the tree. Later on the trees become less sensitive to drying of the soil and accordingly it is possible to allow grass to grow under them or to cultivate wheat or oats.

Special attention should be paid to the trunk and main branches, with should be cleaned every threeye ars by thorough scraping and removing all the old corky bark which shelters insect pests. The bark so stripped off should be burnt. The growths of lichens and mosses, which are often noticeable in damp climates, should be treated with sulphur, iron or lysol.

III. It is usually reckoned that three years must elapse from the appearance of the bud to that of the fruit- bearing, and during that time the "vigour" of the bud goes on increasing. It remains however to be seen whether this vigour consists rather in the number or in the size of the parts and whether there is any real connection between the vigour and these two characters.

The author has been able to ascertain that during the summer months a certain correlation exists, at that time most evident, between the vigour and the dimensions of the small bracts that surround the bud. The growth in length of the bud stops towards the middle of August, equally with the growth on length of the larger leaves. It may be recalled that among the ten bracteolar formations of the bud in existence in April, at least five have been formed in the June to August period of the previous year.

The growth and the primary formation of organs in the leaf and floral bud of the primary axis ceases by the middle of summer, while in the secondary axes they continue till the beginning of the cold weather.

IV. From the continued investigations carried on through six succeeding years on different varieties of apple trees it appears that the flower-bearing buds — or rather those bearing both leaves and flowers — begin to swell towards the second half of March and the first days of April and thus disclose the actual flower-buds, which then come out in April. The actual dates depend on the season, the variety of tree, the position of the buds on the branch, etc.

The time which elapses between the visibility of the petals and the complete unfolding of the flower is in favourable seasons from 10 to 11 days. For the unfolding of all the flowers of a single inflorescence two to six days is usually necessary. The blossoming takes place nearly always in the daylight hours and is at its maximum at midday.

The anthers discharge the pollen one day after the opening of the flower, sometimes also several days after, up to seven : for the most part it takes one to two days for all the anthers in one flower to open. The dehiscence takes place as a rule in the day time and requires from half an hour to some hours for each anther. Rain puts a stop to dehiscence: the pollen sacs after being soaked for some hours close up and thus shelter the grains which they still contain.

The shedding of the pollen follows immediately on the dehiscence of the anthers and in favourable conditions takes less than half an hour, with resulting impollination of the stigmas, carried out by insects, bees, bumble-bees, etc. which however also visit the unopened flowers and those with closed anthers.

The stigmas of flowers which have been open a few hours or are half opened, always seem on examination under the microscope to be very well impollinated: the pollen grains are scanty only in very windy weather or on very cold cloudy or partly cloudy days even when there is no wind. The pollen is caught and held not by the so-called "stigmatic liquid" which, the authors have not been able to trace, but by adherence to the numerous papillae of the stigma which aid the germination.

One or two days after the blossoming and sooner in the case of wet weather, the stigma becomes brown from necrosis of the cells : three to six days after the petals fall, the process being hastened by strong winds, or prolonged rain and delayed by calm or cold weather and marked humidity.

As regards the setting of the fruit the authors, contrary to the usual opinion, have observed that fine days are not the most favourable ; but on the contrary days that are partly fine and partly cloudy, with or without light rain, with an average temperature of from 10° to 16° C. and a humidity of 45 to 75 %. On the other hand windy days are unfavourable and so are days that are partly fine but with a good deal of rain or a temperature below 8°C., or cloudy days with or without rain.

Apart from the season the flowers that first open have the best chance

of setting their fruit on account of the larger quantity of nutritive material available.

There is a very great difference between the number of the flowers that open and that of the fruits that set, inasmuch as very many flowers and many small fruits fall in the first period of their development. This "fall" is particularly noticeable in the second, third or fourth week after the opening of the flower and may continue till towards the ninth, and may be due to parasitic or to physiological causes. In spite of frequent and plentiful sprayings with insecticides, etc., much loss is due to the former cause. The flowers ar damaged by: *Anthonomus pomorum* (0.3 to 30.4 %), *Hyponomeuta malinellus* (0 to 8.5 %), *Pyllobius oblongus* (0.7 to 1 %), snails (0 to 11 %), larvae of *Sessia* sp. (0 to 1.9 %), larvae of a Geometrida (0 to 2.2 %). The small fruits fall as the result of: *Hoplocampa testudinea* (0. to 7.5 %), *Carpocapsa pomonella* (0 to 2.2 %), *Sphaeropsis malorum* (0 to 8.8 %) and up to 7.3 % fall as the result of causes not fully ascertained.

Much more serious is the falling from physiological causes, by which from 45.1 to 97.3 % of the flowers or the small fruits are lost and which is due to imperfect pollination, or to deficiency of carbohydrates, nitrogenous substances or water. The consequence is that only from 0.3 to 29.3 % of the flowers succeed in producing ripe fruit.

During the development of the fruits the styles and stamens still present dry up, the sepals rise and enclose the thalamus, the shape of the apple goes through various changes, pits form round the calyx and the peduncle, etc.

The final size attained by the fruits depends on various causes, the most important of which is the number of well-formed seeds which they contain. A. F.

859. **American Stocks in Viticulture in South Africa.**

DU PLESSIS, A. M. *Journal of the Department of Agriculture*, Vol. X, No. 5, pp. 391-404, plates 8. Pretoria, 1925.

The author gives botanical descriptions and notes on the following hybrids tested in South Africa.

Riparia × *Rupestris* 101-14. The cuttings of this hybrid root and graft easily and give strong, fruitful, grafted vines. Gives good results on a variety of soils.

Riparia × *Rupestris* 3306. Strong grower on fertile soils. Cuttings root easily. Highly resistant to phylloxera.

Riparia × *Rupestris* 3309. Strong grower on fertile soils. Has given good results in fairly dry and heavy soils. Cuttings root and graft well. High resistance to phylloxera.

The above three hybrids are highly resistant to phylloxera; root and graft easily, and have good affinity for most vinifera varieties. They are among the very best stocks in use to-day.

Notes are given respecting the following hybrids, which however proved to be less successful or have not yet been fully tested: *Riparia*

× *Berlandieri* 420 A, *Riparia* × *Berlandieri* 34 E. M., *Riparia* × *Berlandieri* 157-11, *Riparia* × *Cordifolia* 125-1, *Riparia* × *Rupestris* × *Cordifolia* 106-8, *Riparia* × *Solonis* 1616, and *Jacquex*. W. S. G.

860. **Eucalyptus Species for Supply of Electric Power Transmission Poles.**

SIMMONDS, J. H. *New Zealand Journal of Agriculture,* Vol. XXX, N° 3, pp. 157-166. Wellington, 1925.

The author alludes to the suitability of various species of Eucalyptus for supplying transmission poles, and states the restrictive factor in the limitation of the range of this genus is temperature. Causes of former success s and failure of plantations in New Zealand are discussed.

Descriptions of many species are given and in order to assist the planter in selection of species for his particular district, the following table is given, the order being that of resistance to low temperatures:

Climatic conditions	Species
Winters with severe and prolonged frosts and heavy falls of snow.	*E. Gummii, E. gigantea, E. Dalrympleana* (probably).
Winters with frequent severe frosts and occasional snow.	*E. viminalis, E. gigantea.*
Winters with many frosty nights usually followed by clear days.	*E. globulus* (seaboard), *E. Macarthuri* (inland), *E. Acervula, E. eugenioides.*
Winters with mild frosts usually followed by clear days.	*E. eugenioides, E. saligna E. botryoides, E. hemiphloia, E. Muelleriana, E. sideroxylon, E. laevopinea* (probably), *E. Bosistoana* (probably), *E. pilularis.*
Winter without or almost without frost, with many hot days in summer.	*E. longifolia, E. corynocalys, E. crebra, E. paniculata, E. siderophloia.*

W. S. G.

LIVE STOCK AND STOCK BREEDING.

General.

861. **The Disinfection of Stables.**

POPE G. W. (Veterinarian, Field Inspection Division, Bureau of Animal Industry), *Farmer's Bulletin* N° 954. *U. S. Department of Agriculture,* 12 pp. 7 fig. Washington D. C. 1925.

After having shown the necessity for disinfection the author describes various disinfectants, indicating their method of use, bactericidal value, advantages and drawbacks. He examines successively: bichloride of mercury, chloride of lime, chlorine gas, formaldehyde, pure carbolic acid

crude carbolic acid, creosol, solutions compounded with creosol. To insure thorough disinfection is required:

(1) A preparation of the building to be disinfected so as to facilitate contact of the disinfectant with the disease germs.

(2) A disinfectant appropriate to the germs to be killed.

(3) A method of application insuring the most intimate contact with the bacteria.

Explanatory figures show stables easy or difficult to disinfect and a series of disinfecting apparatus capable of giving good results.

P. D.

862. **Paralysis of Chickens due to Coccidiosis.**

LEYNEN, E. (Director of the laboratory of the veterinary Inspection) Paralysie des poussins due à la coccidiose. *Annales de médecine vétérinaire*, Vol 70, nº 3, pp. 101-107, bibliography. Brussels, 1925.

Coccidiosis is caused by *Eimeria avium*, an unicellular protozoa, living in the small intestine of the caecum of the hen. The presence of coccidiae is almost constant in adult fowls without causing casualties; the disease principally affects young chicks about 17 to 30 days old; the affected chicks have their feathers ruffled, suffer from a white, chalky diarrhoea, striped with blood; death ensues in from 3 to 7 days. Mortality may be excessively high and is heavier when the affected chicks are younger. An autopsy shows the principal injury to be in the caecum, the mucous membrane of which is eroded and contains the coccidiae. The latter reproduce in two ways: (1) sexual reproduction, giving birth to the cocyst expelled by the germ bearers, capable of living in the external medium where it undergoes various transformations in 4 or 5 days and then becomes infections; (2) an asexual reproduction: when it reaches the small intestine, the oocyst sets free the sporozoites under the action of the digestive juices; these penetrate into the epithelial cells of the small intestine, curl up, grow at the expense of the cell, become spherical and are then called schizoites. At this stage the parasite undergoes various transformations and finally produces merozoites which penetrate into fresh cells of the small intestine.

At a given moment, these merozoites undergo a sexual differentiation and produce microgametes and macrogametes the union of which produces the oocyst and assures the perpetuation of the species.

Coccidiosis also occurs in older fowls and shows itself by symptoms which are generally not seen in the young chick. Mortality may be heavy; the fowls attacked suffer from paralysis especially in the feet, rarely in the wings. The disease runs its course in 7 to 15 days, reducing the fowls to skeletons.

As the different stages of the coccidia succeed one another inside the epithelial cells of the intestine, remedial agents have but little effect on the parasite and treatment should be primarily prophylactic.

The expelled oocyst requires 3 to 5 days before becoming infections and must therefore be destroyed during this period by carefully removing and burning the excrements.

A good layer of quicklime should be spread over the run and the earth turned over to a depth of 30 cm.; careful cleaning of the premises is an indispensable factor of success. As a medical remedy, cachou at a strength of 1 : 4000 has in several cases given satisfactory results.

Whipped milk may also be used, while greatly decreasing the grain or maize ration; a little grain is given in the morning, then whipped milk until 3 p. m., to avoid fermentation at night in the crop, and in the evening a rather larger quantity of grain so as to fill the crop for the night; when the milk is removed, water is placed at the disposal of the young chicks. This regimen makes the excrements rather liquid, consequently the floor of the poultry house should be covered with short straw, renewed every day; the premises should be well ventilated and kept quite dry and the temperature kept as even as possible. Avoid sudden changes of temperature and in the diet, which favour an outbreak of coccidiosis.

After 8 to 10 days of this diet the disease will be arrested and the paralysed chicks will rapidly recover. P. D.

863. **Variations and Constant Relations in the Quantity of Milk and the Fat Content.**

STREMLER, J. (Chemist to the « Compagnie générale du lait », Rumilly (Haute Savoie). Variations et rapports dans le quantité de lait et la teneur en matière grasse. *Le Lait*, Year V, Vol. 5, No. 44, pp. 353-359. Lyon, 1925.

The object of this investigation was to decide the following questions: Which milking is richest? Which gives most milk? Has the interval between milkings any influence?

Two milkings a day, morning and evening, are assumed. The statements and conclusions which follow are based on a series of several hundred analyses made during a period of nearly 3 years, on mixed milk from a collction of 3500 to 4000 cows. By means of rapid collection made twice a day, the milk of the evening was kept separate from that of the morning. All precautions were taken in the collection of samples.

In summer, in the district in question, 6 to 7 hours elapse between the evening milking and that of the morning and 17 to 18 hours between that of the morning and that of the evening; in winter, this is reversed.

The two milkings, were found to be equally rich, if made at 12 hour intervals and this holds for any season. In winter when the time which elapses between the morning milking and that of the evening is less than that which elapses between the evening milking and that of the following morning, the evening milk is richer than that of the morning to the extent of 7 gm. difference per litre. In summer, the reverse is the case; the morning milk is the richer to the extent of 4.5 gm.

At mid-April or at the beginning of September when the interval between two milkings in exactly the same (12 h.), the richness of the milk is exactly the same.

In determining which milking gives most milk, the interval between the milkings has most influence. In winter the evening milking is less abundant; in summer the contrary.

If the milkings are at an interval of 12 hours, there is the same quantity of milk.

From these observations the author draws the following conclusions:

(1) If the quantity of milk produced increases, the fat content decreases; the greater the quantity of milk, the lower the quality.

(2) The greater the interval between two consecutive milkings, the more abundant is the second, but lower in fat content.

(3) The quantity and fat content of the morning and evening milks are the same, for a large number of cows in good health, if the interval between these milkings is 12 hours.

(4) If, in winter, the morning milking (in summer, that of the evening) is less rich and more abundant in quantity, it is because, having more repose between the two milkings, the udder stores up more milk.

P. D.

864. **The Effect of Season on Milk and Fat Production of Jersey Cows.**

ELMER WYLIE C. (Department of Dairying. University of Tennessee, Knoxville, Tennessee). *Journal of Dairy Science*, Vol. VIII, No 2, pp. 127-131, 2 fig. 2 tables, bibliography. Baltimore, 1925.

It is a well established fact that the milk production of a cow decreases as the lactation period advances and that the percentage of fat in the milk increases in the course of the same period. On the other hand recent researches have shown that there is an important relation between the season of the year and the quantity and richness of the milk produced.

In order to determine the combined effect of the lactation period and the season on the production and richness of milk, the author has examined the records of over 2900 cows included in the " Register of Merit Record of Jersey Cows " of the American Jersey Cattle Club.

Cows which commence their lactation periods in May and in July give on the average richest milk respectively in the 9th and 7th month of their lactation periods. Those which commence in June give a higher average percentage of richness of milk in fat from th 8th to the 10th month of their period of lactation than during the 12th month.

The average annual percentage of fat in the milk was highest for cows commencing their lactation periods in July, August, September and was higher by about 5.45 %.

The annual production of milk was highest for cows commencing their lactation in July, October, November, December, January, February and March; it was in all cases more than 8800 lbs. (3992 kg.).

The production of cows commencing their lactation in April, May, June, August and September was less; the average difference between the two groups was however slight.

The average annual production of fat was highest for cows calving in July, October, November, and December, in all cases exceeding 477 lb. (216 kg.) That of cows calving in April, May and August was less and always below 468 lb. (212 kg.).

The season of calving and the period of lactation affect the richness of the milk, in the sense that the richest milk is obtained a certain time before the end of the lactation period depending on the month in which the cow has calved. P. D.

865. **The Food Value of Algae.**

BROCQ-ROUSSEUX. Utilisation des Laminaria pauvres en sucre pour la nourriture des chevaux. *Recueil de Médecine vétérinaire*. Vol. CI, No. 6, pp. 146-161. Paris, 1925.

Results of investigations undertaken by the author on the food value of Laminaria poor in sugar for feeding horses.

In a first experiment continued for 5 months in a regiment of artillery at Rennes, two batteries, one light and the other heavy, were selected the horses of which, numbering about 120, were given 2 kg. of algæ containing 17 to 18 % of sugar, in place of 0.600 kg. of oats and 2 kg. of hay, or, taking into account the equivalent of hay-oats, a replacement of 1.600 kg. of oats by 2 kg. of algæ.

Two batteries of the same strength served as control; at the end of the experiment no difference was noticed in the condition of the horses fed on algæ and that of the control horses.

It appears therefore that the Laminaria have a definite food value and are not dangerous to animals. The author in continuation of studies has investigated in what proportions algæ poor in sugar can replace either hay or oats.

A. Replacement of hay by algæ poor in sugars. — Experiment made with Laminaria, the sugar content of which was, on the average, 8.12 %; it dealt with two pairs of horses with two waggons travelling 21 km. every morning at walking pace. Work at the same time, animals weighed on return form work, food weighed, water consumed measured, the residues of rations weighed next morning. After having determined the ration required to keep the animals at an even weight, with the given work and having accustomed the animals to algæ (period of preparation of the animals 131 days) the writer began to feed the algæ in place of hay, to one horse of each pair, the other horse continuing to get the equivalent ration (period of consumption of algæ 70 days). The horses received the following rations:

I			II		
Oats	5	kg.	Oats	5	kg.
Hay	3.850	»	Alga	2.5	»
Straw	2.800	»	Straw	2.8	»

At the conclusion of the experiment no noticeable difference was recorded in the weight of the horses, one of the animals consuming algæ left every day from 100 to 300 grm. It may therefore be admitted that 2.5 kg. of algæ can replace 3.5 kg. of hay, which implies that the Laminaria can replace the hay of the ration for animals working at walking

pace, and the equivalence in the case of a daily ration of 3.850 kg. is 3 of algæ for 4 of hay.

B. *Replacement of oats by algæ poor in sugar.* — Experimental conditions as before. After the period of equilibrium, one horse of the pair was given algæ. The animals not eating algæ were fed the equivalent ration :— Oats 5 kg., hay 3.85, straw 2.5 kg.; the others had 1 kg. less oats which was replaced by 1 kg. of algæ. After 30 days all the horses had gained in weight, but those which had eaten algæ gained less than the others. It was decided to raise the ration of algæ to 1.250 kg., the other conditions remaining the same; after 30 days 3 horses out of the 4 lost weight, the average being against the animals given algæ.

The ration of algæ was raised to 1.500 kg. and after 30 days all the horses regained weight, the increase being in favour of the animals given algæ; this was verified during a fresh period of 30 days, hence it appears that 1.5 kg. of algæ can replace 1 kg. of oats.

The ration of algæ raised to 2 kg. and then to 2.5 kg. enabled the accuracy of the above-mentioned equivalence to be verified, for the animals eating the algæ gained more weight than the others as soon, as the equivalence was exceeded.

To sum up :—

(*a*) 1 kg. of algæ is equivalent to 1.33 kg. of hay;
(*b*) 1.5 kg. of algæ are equivalent to 1 kg. of oats, and;
(*c*) 2 kg. of hay equal 1 kg. of oats.

Hence, 1.5 kg. algæ = 1 kg. oats = 2 kg. hay.

There is close agreement of the figures, which proves that the equivalence determined by the two separate experiments is very nearly accurate.

The author has shown by these experiments that algæ are harmless as a food, as was proved by the large quantities of algæ consumed. Moreover, one horse was able to consume 585.4 kg. of algæ in 301 days without the slightest inconvenience.

It is easy to understand the interest which these researches have for farmers near the coast and also for those of other areas, for dried algæ are very easily kept for years without deteriorations. P. D.

866. **The Effect of Cane Molasses on the Digestibility of a Complete Ration fed to Dairy Cows.**

WILLIAMS, P. S. (Department of Dairy Husbandry, Pennsylvania, State College). *Journal of Dairy Science*, vol. VIII, No. 2, pp. 94-104, 6 tables, bibliography. Baltimore, 1925.

The author's experiments were made for determining the effect of cane molasses on the digestibility of a complete ration fed to dairy cows.

The experiments were divided into 3 series, A., B. and C., and each of

the series included 3 tests; series B. and C. were exact repetitions of the 3 tests in the series A.

SERIES A.

Test 1: — 4 Holstein pure-bred cows getting a ration of concentrates + hay and ensilage.

Test 2: — The same 4 cows with the same ration as in test 1 + a quantity of molasses equivalent to 15 % of concentrates.

Test 3: — The same 4 cows with the same ration as in test 1 + a quantity of molasses equivalent to 25 % of the concentrates.

Each of the tests lasted for 21 days, of which 10 days were a preparatory period and 11 days the actual test.

During the whole experiment the animals were given a complete balanced ration (maintenance ration + production ration) calculated according to Armsby's food standards, so that at the conclusion of the tests there was no appreciable difference in the weight of the animals. Food and drinking water were given at regular intervals, 3 times a day, immediately after milking; in addition, the animals could drink daily at 10 o'clock after the daily weighing.

The molasses was dissolved in double its weight of warm water and the mixture poured over the food placed in the manger. A study of the milk production during the tests shows a progressive decrease in output such as occurs in normal conditions as the period of lactation progresses. All precautions were taken to collect carefully all the faeces and urine, separately for each animal. The excrements were weighed once a day at 8 o'clock in the morning.

The period of effective record was 10 days, for the 1st day of the 11 was omitted with a view to assuring as normal conditions as possible.

Exactly aliquot samples of excrements were taken daily and kept so as to constitute an average sample: at the expiry of each period of record, the nitrogen was measured by KÖENIG's method and the other constituents according to the methods usually followed. For calculating the coefficient of digestibility and compiling the tables the author assumes that the molasses is completely digested and, consequently, he does not take into account the nutritive elements of the molasses in calculating the food ingested. This method allows of direct comparison of the nutritive food ingested and the eliminations in the excrements in view of the calculations of the percentage of digestibility.

The numerical data of the experiments show that the digestibility of crude cellulose, of the non-nitrogenous extracts and of the ether extract is not uniformly affected, one way or the other, by the presence of molasses in the ration.

Molasses have a tendency to diminish the digestibility of crude protein and dry matter; however this decrease is so slight that it is scarcely appreciable in practice.

P. D.

[866]

867. **Yeast as Supplementary Food for Dairy Cows.**

ECKLES C. H. and WILLIAMS V. M. (Division of Dairy Husbandry, University of Minnesota, St-Paul Minnesota). *Journal of Dairy Science*, vol. VIII No 2, pp. 89-93. Baltimore, 1925.

Researches on the effect of the use of yeast as supplementary food for cows in milk and its influence on the content in vitamine B of the milk produced.

The authors used, as animals for the experiment, 8 cows divided into two groups fed as follows :

	Group 1	Group 2
1st. Period (40 days)	Basal ration + yeast	Basal ration
2nd. » (40 »)	Basal ration	Basal ration + yeast
3rd. » (40 »)	Basal ration + yeast	Basal ration

The first ten days of each period are considered as a trial period and the comparison of results is made for the 30 following days.

The basal ration was composed as follows : — lucerne hay, maize silage, dry beet pulp and a concentrate (ground maize 2, ground oats 2, wheat bran 2 and linseed cake 1). The fodders were given *ad libitum*, the concentrate was fed in such proportion as to give slightly more than the protein and energy needs required, calculated according to Armsby's standards, so that the yeast supplement might act fully, without limitation consequent on a deficiency of food.

Dry commercial yeast was used at the rate of 55 gm. per day and per kg. of milk produced (25 gm. per day and per pound). The following are the results obtained : In group 1, the average yield of milk during the periods in which the supplement of yeast was fed was 26.4 lbs. per day against a daily average of 26.5 lbs. during the 2nd period without yeast.

For group 2 the average yield was 25.6 lbs. for the periods with basal ration against 25.2 lbs. for the period with basal ration + yeast. As regards the average daily yield in fat the respective figures were :

Group 1 : 0.942 lbs. without yeast and 0.957 lb. with yeast.
Group 2 : 0.897 lbs. with yeast and 0.925 lb. without yeast.

The addition to a normal ration for dairy cows of yeast to the extent of 25 gm. per day and per pound of milk produced does not cause either an increased yield nor an increase in the richness of the milk ; further, no special effect was noticed either in the state of health or in stimulation of appetite. P. D.

868. **The Volume of the Ration.**

LEROY, A. M. (Head of the Stock Breeding Department of the National Agricultural Institute) Le volume de la ration. *Revue de zootechnie, la revue des éleveurs*, Year 4, No. 5, pp. 299-305. Paris, 1925.

In the problems of the scientific feeding of animals it is not enough to determine the number of forage units contained in the daily ration, to

calculate the quantity of energy necessary to an animal organism situated in given conditions of production, to investigate the value of the minimum daily supply in proteins, the presence of which in the foods enables the symptoms of lack of nitrogen to be avoided, but it must also be assured that the daily quantities of forage which the application of the usual method provides are in proper relation to the digestive capacity of the animals in question, especially so that excess may be avoided.

Species of domestic animals react differently under the influence of a ration too rich in indigestible matter : ruminants have a greater capacity than horses for the consumption of bulky foods ; pigs, proportionally to their weight, have the smallest digestive capacity.

Each animal should receive a given quantity of dry matter, neither too much nor too little, which depends on its species, weight, age and the nature and intensity of its production. It is therefore necessary to determine the coefficient of bulk of each of the forages capable of being included in the ration, that is to say, the quantity of dry matter, expressed in kg., contained in a forage unit of each of the foods considered.

In a table the author calculates the coefficients of bulk of some of the principal forages based on the fact that green forages represent, in proportion to the volume of the ration, the best balanced category of foods ; he deduces from this that the coefficient of bulk of rations should as nearly as possible approach the figure which corresponds to meadow grass, namely 1.3.

In a second table are shown the amplitude of variations in the coefficient of bulk of the ration admissible for each species and in each particular case. The practical application of the preceeding data are then studied by considering a type ration for a dairy cow of 700 kg. giving 30 litres of milk per day. The ration contains 15.03 forage units and 21.89 kg. of dry matter ; the coefficient of bulk is therefore :

$$\frac{\text{dry matter}}{\text{forage value}} = \frac{21.89}{15.53} = 1.46$$

It is evident that it is not possible, without causing a loss of appetite and consequently a decrease in production, to replace in the proposed ration a portion of the concentrates by hay or straw.

This method of calculating the bulk of the ration is simple and enables the content in dry matter of a ration to be usefully modified, without modifying its forage value, that is to say to determine the possibility or otherwise, from a physiological point of view, of food substitutions, which may appear desirable on account of the market rates of foodstuffs. P. D.

869. **Experiments on Stock Feeding at the Stock Breeding Centre of Clos Ry (Nièvre, France).**

MASSÉ. A. Expériences sur l'alimentation du bétail au Centre Zootechnique du Clos Ry (Nièvre, France). *Comptes Rendus des séances de l'Académie d'Agriculture de France*, Vol. II, No. 8, pp. 297-310. Paris, 1925.

An account of some experiments carried out at the stock breeding Centre of Clos Ry, relating to the scientific feeding of stock.

The first experiments dealt with the fattening of pigs; 12 pigs were taken, 6 of Croannais breed 8 ½ months old, and 6 derived from a cross Large White-Craonnais, 7 months old; the 12 animals were divided into 3 lots of 2 pure Craonnais and 2 Large White-Craonnais, subjected first of all to the same diet, and afterwards to different feeding. The conclusions as to the net cost per kg. of increased growth, to the influence of the feeding on the quality of the meat, and to the influence of the breed on the aptitude for fattening, may be summed up as follows:

Potatoes and barley meal may be replaced by oil cakes without disadvantage. Palm oil cake is liked by the animals, even in large quantities, and its use is very profitable.

Substitution may be effected on the following basis: 1 kg. of cake = 1 kg. of barley; 1 kg. of cake = 4 kg. of potatoes.

A series of experimental researches were next carried out on sheep: meat production with Southdown, Berrichon and industrial cross-bred Southdown × Berrichon. Two lots of 20 lambs were formed, each including 10 males and 10 females and, in each lot, six twin lambs. The mothers had received the same feed of hay and mangels; the lambs were also given the same feed and received from the 30th day a ration which was progressively increased, composed of mangels, bran and barley meal.

After a few months, 5 males of each lot were castrated.

From the records made it appears that: In each breed, the males are larger at birth than the females and in the Southdown breed the difference is greater; in both breeds subsequent growth seems to be in direct correlation with the initial weight.

Advantage from a growth standpoint lies decidedly with the castrated lambs.

From the point of view of comparative growth the Berrichon is slightly better than the Southdown; the average daily growth was in fact 0.1775 kg. for Southdowns and 0.1919 kg. for Berrichons. From the yield standpoint the advantage lies decidedly with the Southdowns, with a yield of 53.2 % against 49.3 % for the Berrichons. The author remarks that he is dealing with the results of only one year, that this should be taken into account in drawing conclusions and that the experiments should be continued and also carried out on crossbred Southdown-Berrichon lambs.

A third experiment dealt with the comparative value of barley meal and manioc meal for fattening cattle. The experiment was made on young Charollais bullocks aged from 16 to 20 months, of the same paternal origin and as similar as possible as regards shape and fineness of tissues. Two lots as homogeneous as possible were put into stalls on the 17 November and given the same feed up to the 22nd, hay and mangels mixed with chopped straw. From the 22nd they received equal rations, except that for the 2nd lot the manioc meal fed to the bullocks of the 1st lot was replaced by an equal weight of barley meal. It was noted that the manioc meal mixed with the mangels was as much liked as the barley meal; the nutritive value is approximately the same.

Consequently, the use of one in preference to the other should be decided by the market prices of the two foods. P. D.

[869]

870. The Breed.

DECHAMBRE P. La Race. *Revue de Zootechnie, La Revue des éleveurs*, Vol. IV, N° 4, pp. 251-259. Paris, 1925.

The Higher Committee of Herd Books, in consequence of a discussion which occurred during one of the meetings of the Congress of Herd Books charged one of its members to study and report on the question of the " breed " so that satisfactory understanding might be arrived at regarding the signification and scope of this term in frequent general use.

The author studied the term and its significance as used in biology and in general ethnology, and in breeding practice, to draw from them useful conclusions for stock breeders.

The distinction which should be established between *breed* and *type* must be clearly understood.

The *Type* should be considered as the form round which individuals composing the breed are grouped ; it appears as a theoretical figure independent of all idea of affiliation and living representation.

The *Breed* is constituted by the collection of individuals which descend one from another and which possess the totality or the greater part of the characters of the type.

Hence, a type being given and defined by a small number of characters recognised as fundamental, may be represented by several breeds separated from each other by one or several distinctive characters.

Regarding the breed in the practice of breeding, it may be defined as a collection of individuals of the same species, in which identity of origin is expressed by similitude of bodily forms, coat, plumage, having the same productive qualities, the same temperament and the same aptitudes.

It is however very difficult to prevent the signification of the term " breed " from having a certain conventional character, which in the consequence of several circumstances inherent to habitual conditions of the practice of breeding :

(1) Breeds, even the best defined, always contain individuals which resemble more or less, neighbouring breeds.

(2) In many domestic species and for many economic or other reasons, cross-breeding has happened frequently enough for there to be difficulty in determination and delimitation, even in breeds qualified as pure.

(3) The term " breed " is often applied, in practice, to groupings of artificial origin obtained by the mixture of several others. Cross-breeding has given rise to a great number of these combinations as well as continuous crossing not extended to total absorption. It is however right and necessary to note that if in certain cases the qualification of breed is unsuitable to too recent operations of crossing or cross-breeding, in others it is justified by the homogeneousness of the characters, the almost complete absence of throwing back and the care with which multiplication is looked after.

Hence, it may be said that:

(*a*) The *breed* is the genetic group which comes immediately after the species in the scientific nomenclature ordinarily adopted.

(*b*) It is defined by a collection of general characters which are *ethnical* characters (profile, form of the head, proportions, weight, coat, horns, hair, etc.) and not *specific*.

(*c*) A given breed belongs to a given type, that is to say to a general diagrammatic formula of which it is the representation drawn from a variable number of individuals.

(*d*) The same breed may be differentiated into secundary groups or "sub-breeds" which however should not be multiplied, but, on the contrary, should be made to return to the same general formula as soon as the essential morphological characters and the aptitudes are the same.

(*e*) The term "*variety*" actually corresponds only to a group in process of formation whose characteristics are not yet fixed.

(*f*) In the case of groupings obtained by crossings or by cross-breedings, the appellation "breed" should only be conceded after much circumspection, so as not to accord it to groups in process of formation without stability and without guarantee of true breeding quality.

(*g*) All the above considerations are necessarily of a very general character, for they should apply to all domestic species with which the Higher Committee of the Herd Books may have to deal. P. D.

871. Are Milk Record Association Results Accurate?

CANDLISH, A. C. and VICAR, A. (Milk production Department, West of Scotland Agricultural College). *The Scottish Journal of Agriculture*, Vol. VIII, No. 2, pp. 201-205, 4 tables. Edinburgh, 1925.

In view of the investigation of the degree of accuracy of results obtained by milk record associations these results have been compared with those given by the weighing, after each milking, of the milk yielded by each cow of a single herd.

The estimate of yield according to the results supplied by the milk record made at intervals of 10, 20 and 30 days, so as to determine the influence of the period between two records on the accuracy of the results, was effected by two methods.

(*a*) Old method: at the time of the first record of the lactation the total milk (morning milking + evening milking) given by each cow was multiplied by the number of days which have elapsed since calving; at the time of subsequent records the total quantity of milk of the two milkings was multiplied by the exact number of days elapsed since the previous record.

(*b*) New method: At the time of the first record of the lactation, the total quantity of milk of the 2 milkings of a cow was multiplied by the number of days elapsed since calving + half the number of days of the average interval between records; at the time of subsequent records, the total quantity of milk of the 2 milkings was multiplied by the exact num-

ber of days between the records, that is to day, the day of record was considered as the middle day of the period included in the record.

The following is the average of results obtained with 24 cows:

Number of cows	Actual yield (weighings)	Estimated yields					
		Old method			New method		
		Tested every 10 days	Tested every 20 days	Tested every 30 days	Tested every 10 days	Tested every 20 days	Tested every 30 days
24	642 gallons	631 gallons	617 gallons	594 gallons	647 gallons	647 gallons	643 gallons

The average results obtained by means of the old method of estimation with the figures given by records made at 10 days interval, differ from the true average obtained by weighings of the milk by less than 2 %; with the new method, the results are a little closer and differ from the true average by less than 1 %.

If instead of considering average results the individual records are observed we get the following table:

Method	Average yield	Variation from the actual average yield	Maximum variation		Extent of variation
			Increase	Decrease	
	Gallons	Gallons	Gallons	Gallons	Gallons
Old method:					
Tested every 10 days	631	— 11	9	36	45
» » 20 »	617	— 25	—	65	65
» » 30 »	594	— 48	—	93	93
New method:					
Tested every 10 days	647	5	24	13	37
» » 20 »	647	5	25	32	57
» » 30 «	643	1	46	36	82

The records estimated according to the new method with intervals of 10, 20 and 30 days between records do not show any important variations compared with the actual yield, when the average for the herd in considered the individual variations increase according as the interval between successive records is increased. However, even with a period of 30 days between 2 records, they are not large enough to destroy the practical value of the results.

This is not the case for results obtained according to the old method of estimating the yield; with that method, with 10 days interval, the average variation is less than 2 %, but increased to 4 % for 20 days interval and to over 7 % for 30 days interval.

The new method of estimation therefore gives a much closer approximation in all cases than the old method.

The study of the length of the period of lactation throws some light on this subject.

The average actual length of the period of lactation is 265 days according to the new method of estimation we get 265 or 266 days as the average length of the period of lactation , while with the old method the average length of the period of lactation is respectively 261,256 an 251 days for the respective intervals between 2 records of 10, 20 and 30 days. This means that, according to the old method of estimation, the average length of the period of lactation is shorter than the actual length by about one half of the period between 2 testings. This is due to the fact that the end of the period of lactation does not always coincide with a testing day, but more often occurs at some time or other between 2 consecutive testings. The weighing operations and the calculations of the yield did not commence on the average, until the 5th day after calving, that is to say at the end of the period of the colostrum; for greater accuracy the average production of the first 5 days, about 18 gallons, should be added to the average production indicated.

Hence, it may be said that the new method of estimation gives very satisfactory results, sufficiently accurate for the estimation of records.

P. D.

872. **Calculating the Average Production of a Dairy Herd.**

BECKER, R. B. (Division of Dairy Husbandry, University of Minnesota. University Farm, St-Paul, Minnesota). *Journal of Dairy Science*, vol. VIII, No. 2, pp. 105-114. Baltomore, 1925.

To appreciate correctly the value of a dairy herd, it does not suffice to consider the exceptional records given by certain cows, but on the contrary a high average production of the whole herd should be sought for as proof of power to transmit the character of high productivity.

The object of the author's report is to discuss some of the methods of estimating the average production of herds hitherto used and to bring to notice a more accurate method recently devised by himself.

For the comparison of methods the author utilizes the production records of a herd belonging to the Sunflower Cow Testing Association of North West Kansas.

The "equivalent average" method considers the number of milking days in the course of the year ; by dividing this number by 365 we get the average number of cows milked each day. If the total production in milk and in fat is then divided by the average number of cows milked each day, the average production per head per annum is obtained. This method based on the supposition that the cow is milked 365 days a year, gives too high results not giving an accurate account of the average production, especially in a herd in which the cows have an abundant milk production in a short period of lactation.

The "rough average" method estimates the average production by dividing the total production of the herd by the total number of cows which have calved before or during the course of the year considered. This method somewhat under-estimates the actual average production of the herd, it does not allow for cows which do not accomplish a complete period

of lactation (sale, death) ; in addition the heifers which commence their lactation towards the end of the year cannot give the complete and accurate measures of their capacity of production, but enter into the account in the calculation of the average production.

The " herd average " method only takes into account for calculating average production, the cows which have commenced their period of lactation before the beginning of the year of record and which accomplish a complete lactation on the strength of the herd in the course of the year in question. This method, more accurate than the two previous methods, has however the defect of not taking into account cows which only accomplish part of their period of lactation during the course of the year considered.

The " cow-month " method brings into account for calculating the average production of all cows in the herd, in lactation or dry, for each month of the year. This total number of " cow-months " for the year divided by 12, gives the number of " cows " in the herd for the whole year.

By dividing the total production in milk and fats by this latter number the average production is obtained with a fairly great degree of accuracy. However, the figure for the average production is slightly too high, for the dry period for heifers commencing their period of lactation towards the end of the year of record is not taken into account.

The Danish method of calculating the average production of a herd is based on the number of days during which the cows consume food during the year. The total of feeding days is divided by 365 so as to get the number of cows in the herd during the whole year and from that the average production is calculated.

This method gives results very near the truth, but however tends to over-estimate slightly the figures of the average production, for it does not take into account a dry period for heifers commencing their period of lactation late.

The author proposes the " lactation average " method. It is based on the average length of the period of a normal cow in the herd ; cows which accomplish their normal lactation in the course of the year are counted as such (1) ; for the cows which only pass a part of their period of lactation in the herd during the course of the year considered, the equivalent number of cows which would have accomplished a complete average lactation is calculated, (2) according to the normal length of the lactation of normal cows of the herd.

The total of (1) + (2) gives the real number of cows in the herd during the whole year and enables the average yield of the herd to be calculated.

The last four methods give results which are near the truth ; however the last method, taking into account a proportional dry period for the cows which only accomplish a part of their lactation during the course of the year considered, represents the normal situation of the herd better, and gives a more accurate result of the true average production.

P. D.

[872]

Special.

873. **Feeding Experiments with Dairy Cows.**

FREDERICKSEN, Prof. L., ANDERSEN, A. C. (Manager) and WENZEL, H. (Assistant). I. Foreløbige oplysuingen om nogle Forsøg met Malkekøer i vinteren 1923-24. II. Plan for nogle Forsøg med Malkekøer i vinteren 1924-25. II. *Meddelelse fra Forsøgslaboratoriet Husdyrbrugsafdeling*, pp. 1-39, 9 tables, 1 graph. A Bang, Copenhagen, 1925.

Second Report of the Domestic Stock-breeding Department of the Experimental Laboratoy.

Preliminary information regarding experiments with dairy cows made during the winter of 1923-24.

A. Constant quantity of Feed and varying Quantity of Protein.

The experiments were carried out by Professor Lars FREDERICKSEN on five farms with 120 cows and in accordance with the following scheme for the amount and type of fodder (three batches of cows):

Batch A:	1 F. U.	with	120 gm.	protein	per	2.6 kilos	4 %	milk	(46.2 gm.	protein	per kilo 4 %	milk)
» B:	1	»	» 96 »	»	»	2.6 »	»	»	(36.9 »	»	» » »	»)
» C:	1	»	» 144 »	»	»	2.6 »	»	»	(55.4 »	»	» » »	»)

The reason why 4 % milk has been chosen for future calculations is explained in the report. In accordance with a very great number of tests of the average combinations of Danish cow's milk it is possible — the fat percentage of milk being known — to find the approximate content of other substances in the milk and to calculate on this basis the heat of combustion of the milk. Mr. A. C. ANDERSEN states this to be (fat percentage × 113.5) 290 calories per kilo. Professor K. MOLLGAARD has further found that the cost of producing 1000 calories in milk is almost the same whether its fat content is high or comparatively low. In bulletin No. 245 of the University of Illinois, W. L. GAINES and F. A. DAVIDSON, following large scale tests of the yields of American cows, suggest the use of the so-called 4 % milk in comparing the yields of dairy cows. The quantity of 4 % milk is found by multiplying the absolute quantity of milk by 0.4 adding to this the fat content of the milk × 15. Professor FREDERICKSEN shows in a table that one kilo of 4 % milk practically contains as many gms, of protein and as many calories, whether, the calculation is made with a fat percentage of 3 or 7.

As regards the carrying out of the experiments, it should be noted that it is necessary to distinguish between a preparatory stage, an experimental stage and a later stage. In the preparatory stage the object was to form three uniform batches, A, B, and C, which in the following experimental stage (about three months) are fed differently: A, normally; B, below the normal; C, above the normal. In the preparatory stage and the later stage, all batches were fed alike (as A in the experimental stage) in proportion to the yielding and body weight of the individual cows. On 2 farms respectively, 4.0 and 3.5 kilos of lucerne hay were fed daily during

the experimental stage to each cow. For batch B the quantity of oil cake on these farms is less than 1 kilo per cow daily. Batch A on these farms was fed daily about 1 $^2/_3$ kilos of oil cake per cow and batch C about 2 $\frac{1}{2}$ kilos of oil cake. For the three farms where hay was not used for fodder, the quantity of oil cake varies per cow and per day from 1.4 kilos (B) to 2.9 kilos (C). The mixture of oil cake was the same for all the farms, having been bought in one lot (the so-called " Korsor mixture " see below). In the feed were also included maslin, mangolds and straw. The maintenance ration is computed in proportion to the body weight of the cow ; 50 gm. protein is reckoned to be contained in it per kilo body weight and is for :

400	kilos	live	weight	2.5	F. U.	containing	200	gm. protein
500	»	»	»	5.0	»	»	250	» »
600	»	»	»	4.5	»	»	300	» »

On an average the following results have been obtained during the experimental period :

		Average for A	B	C
In the feed, gm. protein per kilo 4 % milk		50.2	40.4	58.6
Yielding per cow daily	kilos milk	13.9	13.4	14.1
	gm. butter fat	507	503	518
	kilos 4 % milk	13.2	12.9	13.4
Average weight of cows, kilos		503	502	498
Increase per cow in 100 days, kilos		8.4	3.1	11.6
For 100 production F. U.	kilos milk	250	250	255
	kilos butter fat	9.11	9.40	9.35
	kilos 4 % milk	237	241	242
	kilos growth	1.51	0.58	2.09
For 100 F. U. altogeter	kilos milk	146	144	148
	kilos butter fat	5.30	5.37	5.44
	kilos 4 % milk	137	137	140
	kilos growth	0.88	0.33	1.22

The preliminary statement respecting the two years' experiments with constant quantity of feed (1 F-U per 2.5 kilos 4 % milk) and varying quantity of protein, signifies that the greatest aggregate yield for 100 F-U altogether, is obtained by such batches as have received 50 gm. protein and over per kilo of 4 % milk. With 40 gm. protein per kilo of 4 % milk (batch B 1923-24) during the experimental stage, a decided decrease in the quantity of milk was shewn. An increase in the quantity of protein from about 50 to 60 gm. per kilo of 4 % milk (A to C 1923-1924 and B to A 1922-1923) seems to have caused a small increase in the yields. A further increase in the quantity of protein from about 64 to 77 gm. per kilo of 4 % milk (A to C 1922-23) seems to have caused a small increase in the quantity of milk, but at the same time the growth had decreased.

Taken on the whole the outcome of the experiments with constant quantity of feed and varying quantity of protein, have not been very significant, nor have they been quite homogeneous for all the farms.

B. The special influence of certain kinds of fodder on the quantity and fat content of the milk. Experiments with coconut and palm-nut cakes. By HANS WENZEL.

During the winter 1922-23 a new kind of cake, called "Babassu cake" was tried in a single experiment, with the result that one batch of cows fed with babassu cake thrived just as well as another batch that received coconut cake, and it also appears that for cows that had both kinds of cake, the fat percentage of the milk increased in comparison with other cows fed with other kinds of cake. For a closer investigation of these results an experiment was made during the winter 1923-24 with coconut and palm nut cake compared with others. All the four batches of cows were fed according to the same scheme as the normal batches (A) in the above mentioned experiments, *i. e.* the quantity of feed increased and decreased with both, body weight and quantity of milk and percentage of fat. All cows therefore, have all the time received the same number of F. U. and gm. of protein. The only difference for the batches was the kind of cake at the experimental stage. The cake mixture of the normal batch (the "Korsor mixture") with which the other mixtures are compared, was composed of:

30 % of coconut cake,
30 % sunflower cake,
10 % earthnut cake,
10 % soy cake,
10 % sesame cake,
10 % palmnut cake.

In the experimental stage the various batches received:

Batch A: "Korsør Mixture",
» B: 1/2 » » and 1/2 of coconut cake (65 % coconut cake and 5 % palm cake),
» C: 1/2 » » and 1/2 of palm cake (55 % of palm cake and 15 % coconut cake),
» D: 1/4 of sunflower cake, 1/4 soy cake, 1/4 earthnut cake and 1/4 sesame cake.

All the cows each day had on an average 40 kilos of mangolds and 5 kilos straw. Of oil cake, A. had about 2 1/3 kilos, B. 2 1/3 kilos, C. almost 4 kilos and D 1 2/3 kilos per cow daily. The difference in the quantity of cake is due to the fact that the quantity of protein per F-U had to be the same for the batches, and this was obtained by adding grain. All batches during the preparatory and subsequent stages had "Korsor mix-

ture " instead of cake.The daily average yield per cow (in milk and fat) throughout the experiment was:

		A 30 % coconut cake and 10 % palmnut cake	B 65 % coconut cake and 5 % palmnut cake	C 15 % coconut cake and 55 % palmnut cake	D No coconut or palmnut cake
Kilos of milk	preparatory stage	17.6	17.5	17.6	17.5
	experimental »	14.8	16.0	16.1	15.2
	subsequent »	11.8	12.9	12.7	11.4
% fat	preparatory stage	3.84	3.68	3.67	3.67
	experimental »	3.76	3.74	3.69	3.43
	subsequent »	3.79	3.62	3.63	3.63
gm. fat	preparatory stage	676	644	646	642
	experimental »	556	596	595	521
	subsequent »	447	497	461	414
Kilos 4 % milk	preparatory stage	17.2	16.7	16.7	16.6
	experimental »	14.2	15.3	15.4	13.9
	subsequent »	11.4	12.2	12.0	10.8
Actual experimental stage	growth per cow in 100 days, kilos	13.1	11.9	9.5	8.3
	average weight of the cows, kilos	511	475	485	495

The chief results of the experiments may be thus indicated.

The experiments of 1922-23 and 1923-24 show that certain feeding stuffs have a considerable influence on the fat percentage of the milk. The more coconut, babassu or palm cake contained in the cake mixture, the higher became the percentage of fat. By exchanging half an artificial feed mixture with coconut or babassu cake the fat percentage was raised 1/3 %, and by omitting the 30 % coconut cake and 10 % palm cake contained in the Korsor mixture and replacing them with the other kinds of cake of the Korsor mixture, the fat percentage was lowered 1/4 %.

The influence these cakes have on the quantity of milk is not clearly shown by the experiments, the results of the two years not indicating the same tendency, but even where a decrease has occurred in the quantity of milk, the batches fed with babassu, coconut, or palm cake have, however, in every case yielded the largest quantity of butter fat.

C. The ash content of the Milk (mineral) especially lime and phosphoric acid. A. C. ANDERSEN.

The purpose of the experiment was to ascertain whether the content of lime and phosphoric acid in the milk is subject to important fluctuations during the winter, or is chiefly influenced through the addition of minerals or bone dust. To illustrate this point, large samples were sent in during the period 4th January to 20 June, from the experiments at Rosenfeldt, of the milk of 4 batches for each period of a fortnight. The normal experiments on the farm (under section A) dealt with three batches which, besides the recognised experimental fodder, had a daily addition

of about 50 gm. chalk and bone-dust (equal mixture) per cow; a fourth batch, fed in the same manner as batch A under section A, on the other hand had no addition of chalk and bone-dust.

Altogether, milk samples for 12 periods were sent in, of which the two last periods include the time after the cows had been turned out to grass. From the analytical results it appears that the variations found in the content of phosphoric acid, lime and magnesia, are only insignificant and the batch without the addition of chalk and bone-dust was in no way different from the other batches.

No regular variation in the combination appears during the stall feeding period. On the other hands it seems as if the content of phosphoric acid in the milk decreases, while the content of lime increases when the cows are turned out to grass, but further investigations are necessary before anything definitive may be said on this subject.

Corr. Denmark.

874. **Milk-Production and Draught-Efficiency.**

GUTH. Milchleistung und Zugleistung Burgenländische Rindviehzucht-genossenschaften. *Wiener landwirtschaftliche Zeitung*, No. 15, April 11, 1925. Vienna.

In the recently formed association for cattle-breeding in Unterschützen, in Burgenland, the newest Austrian confederate country, there was introduced more than a year ago an efficiency test. Of the 119 cows tested, 87 were not only employed for milk-production, but also for draught. The average annual production of the cows not used for draught purposes was 2490 quarts (2827 litres), that of the "draught-cows" however 1984 quarts (2252 litres). Thus on an average per year and per cow, 506 quarts (575 litres) of milk were lost As the feeding of all the cows was the same, the equivalent of a cow's draught-efficiency may be calculated as equal to the value of 506 quarts of milk. Hence, it is a question of estimating in each case, which is most economical, milk-production or draught-efficiency, and to ascertain when the loss of milk begins to exceed the cost of a draught animal. Of the dairy cows 75 % gave more than 2202 quarts (2500 litres) a year, whereas of the draught-cows only 26 % gave as much. The maximum milk-yield per cow was 4181 quarts (4746 litres), which, taking into account the primitive breeding and methods of keeping, must be considered as a satisfactory result. H. K.

875. **Improvements in Sheep Breeding in Morocco.**

LALLOUR, M. Améliorations de l'élevage du mouton au Maroc. *Revue de Zootechnie*, la revue des éléveurs, Year 4, No. 4, pp. 279-285; No. 5, pp. 342-352. Paris, 1925.

The number of sheep in the French zone of the Shereefian Empire may be estimated at 10,000,000 head, of which 7,200,000 paid "tertib" in 1924. The evolution of such a flock has, for many years, been obtained principally by persevering selection of indigenous breeds. It is indeed

very difficult to procure imported rams in sufficient numbers; their acclimatization is difficult and mortality high, owing to present conditions of life and also the Moroccan sheep will not be suitable for useful crossing with foreign strains before several years of selection.

The most necessary measure to be taken for the improvement of the Moroccan flocks is a methodical and energetic scheme of selection; the Administration of the Protectorate has begun by the development of castration. The progressive, but as rapid as possible realization of all other processes of selection must now be considered, but the susceptibilities of the natives must be treated with consideration.

The first effort should bear on the native Provident Society and on the important flocks belonging to influential Kaïds; it must next be endeavoured, by emulation and interest, to incline other native breeders to adopt the same methods of selection until it becomes possible to impose them without difficulty, by regulations, on defaulters.

Selection of rams: (*a*) *Castration*.. — During the last 2 years the "Service de l'Élevage" has made a great effort to develop the practice of castration by the use of the Italian pincers. Apart from the production of meat intended for quick consumption, castration on a large scale has for its principal object the selection of rams by the elimination of bad breeding animals. Of course, only the veterinary should be authorized to select the rams to be kept and this selection should not be left to the native castrators who work empirically and contrary to the most elementary stock breeding principles.

(*b*) *Isolation of the rams*. — In Morocco, in the large majority of cases, the ewes and the rams are mixed throughout the year; consequently there are lambs of unequal age and endurance, and lambing at certain seasons entails a heavy mortality. Absolute isolation of the rams during 10 months of the year is not practicable among natives, for that is contrary to long tradition, entails extra cost of herding and deprives the breeder of the double lambing to which he is accustomed. Isolation during 3 months, from the 1st February to the 1st May might be considered: this would prevent lambing in the summer which is detrimental to the ewes and lambs, while facilitating the marking of animals to be kept for selection and those to be castrated or killed. The native owners of large flocks having experience of the mortality in summer and autumn would readily agree to this reform; for the small and medium sized flocks, it would be necessary to institute herding for 3 months at common cost, taking the "*douar*" as unit.

(*c*) *Bonuses for the keeping of classed rams*: These were awarded to the owner of the best selected rams and paid one year after award if the animal was shown in a good condition of preservation and maintenance. They are at present abolished. After experience of the new system of bonuses the "Union Ovine de l'Afrique du Nord" may investigate with the "Service de l'Élevage" whether the re-establishment of this system would be of real use.

Selection of ewes. — This appears to be very difficult to realize in Morocco. In the native flocks, the ewes bear when too young and defor-

mations result which are very prejudicial to subsequent gestations; they also bear too old, when they can no longer give any but inferior produce. The isolation of ewe lambs and the feeding of old, sick, rickety ewes can only be effected through a slow process of propaganda and example by European breeders. Veterinary inspectors should be allowed to purchase for the native Prudential Societies, exceptional animals which they discover in the slaughter-houses. The most urgent questions were the regulation of slaughtering and the export of young ewes; the "dahir" of 12th the June 1920 forbade throughout the French zone of the Shereefian Empire the slaughter of ewes under 2 years old and the "dahir" of 27th January 1923 prohibited the exportation of ewes under 5 years old, except through the customs stations of the Algerian-Moroccan frontier, from the 1st January to the 30th June.

Rigorous application of these measures meets with practically insuperable obstacles. A centre of supervision for the "filtering" of flocks in course of exportation has just been organized at Taza (Vizirial Decree of 7th January 1925, B. O. of 13th January 1915).

The "Union Ovine de l'Afrique du Nord" might usefully help the Moroccan Administration by investigating with the General Government of Algeria the possibility of effecting the unification of the regulations in force in the two countries in the matter of the slaughter and export of ewes.

Selected flocks. — Owing to the difficulty of procuring for native flocks a sufficient number of good rams for their improvement, it is necessary to bring about the constitution of a flock of selected sheep by each of the native Provident Societies for which the best rams would be reserved. This measure would usefully supplement the institution of experimental sheepfolds started by the "Service de l'Élevage"; applied at once and generalized afterwards it would exercise a very favourable influence on the rapid improvement of sheep-breeding in Morocco.

Each selected flock, subjected to the direct control of the veterinary, benefitting by scientific methods (breeding, reproduction, feeding, shelter, care, etc.), would form a nursery of selected breeding animals and a useful example to native breeders.

To constitute them, rams would be purchased by the native Provident Societies and could be obtained either by selection or by importation. The ewes would be borrowed free of charge from native flocks and restored at the age of 5 years to their owners. The lambs, in principle, would belong to the owner of the mother. Until the natives learn the advantages of the system and agree to share the expenses, the cost should be borne by the native Providant Societies.

Cross-breeding. — The introduction of an improving strain is indispensible to the Moroccan flocks for the production of the good quality of wool and meat, of which they are capable; experiments have shown that these flocks are capable of benefitting from the first generation from the important characters of the imported rams. The experiments of the "Service de l'Élevage" are convincing for mass breeding from Cran d'Arles merino rams, either pure-bred or cross-bred with Tunisians.

It would be very desirable for the " Union Ovine de l'Afrique du Nord " to take the initiative in establishing stud farms in the principal breeding centres, where selected rams would be kept and given the necessary care during the intervals in the breeding periods. They would be hired to breeders at the breeding period when they would be supervised by a specially responsible interested keeper.

Organizations of this kind would be realizable under the form of breeders' co-operative societies, deriving their inspiration from the organization of the Moroccan Remount Service.

The " Union Ovine de l'Afrique du Nord " could facilitate the importation of good breeding animals by organizing, in Morocco, annual ram sales following the procedure of the " ventes à porte ". A Decree of the 2nd March 1924 of the Director General of Agriculture has fixed at one hundred francs per animal the amount of the premium instituted by the Vizirial Decree of 1st March 1924, to compensate importers of rams for part of the cost of customs and transport.

Feeding the flock. — The Moroccan sheep is noted for its hardiness, which is very fortunate, for rarely, owing to the laziness and neglect of the native, can it eat when hungry or drink when thirsty. It is to be hoped that the multiplication of dairy cows will cause the milking of ewes to be discontinued and that the example of European breeders and firm action of the authorities will lead to development in the constitution of forage reserves by means of ensilage and haymaking. Moreover, annual change of pasturage is practised in Morocco, very extensively in Eastern Morocco and to a limited extent in the Middle Atlas and Western Morocco. A better utilisation of the available grazing lands must be effected by arrangements between the Administrations of neighbouring regions.

The principal difficulty in keeping sheep in Morocco lies in the supply of drinking water. Much has already been done in this respect by the multiplication of wells, the construction of rough tanks open at the top; but the present state of affairs still leaves much to be desired. A great effort on the part of the Agricultural Irrigation Service is required to give value to large districts of " Sheep country ".

Protection and hygiene of flocks. — The most obvious enemies of Moroccan sheep are the wild beasts; it would be desirable to increase hunting and to give rewards for destruction of wild animals. More destructive than the wild beasts are the numerous internal and external parasites which attacks the flocks. Regular development of veterinary inspections would be the best means of popularizing knowledge of elementary prophylaxis. The general adoption of dipping, with the obligation of active superintendance for maintaining a proper strength of the liquid would be very desirable. For the protection of the flock against weather conditions the native should be induced to make increasing use of rough shelters and to keep them in repair.

Shearing. — Takes place in Morocco from March to the end of May, from day to day, when there is leisure or the owner needs money. It is done with rough instruments and the shearers neglect to shear the wool on the belly. The cost of shearing by hand is very high :— 1 fleece in 25

or 4 to 5 % of the value of wood shorn, or the wool from the neck and head. Mechanical shearing, in addition to cleanness and rapidity in the operation, would lead to supression of fraud and shearing wounds, simplification in prophylactic attention and facility of control of the sanitary condition of the animals, grouping of the operations of collecting and despatching the wool and a gain of 250 gm. of wool per fleece. The " Union Ovine de l'Afrique du Nord " should establish in the principal breeding centres shearing co-operative societies carrying out shearing on contract for the breeders and merchants. These co-operative societies could benefit by long term agricultural loans free of interest, by means of agreement between the Protectorate and the Morocco State Bank.

Frauds and classification of wools. — The adhesion of milk, sand, dung, etc. is the greatest obstacle to the development of trade in Moroccan wools. The breeders are not alone responsable and the middlemen share the responsability in a large measure. The " Union Ovine de l'Afrique du Nord " should do all in its power to carry out improvements in this respect.

A fresh classification of Moroccan wools is also imperative, for the present classification at Aboudia, Urdighia and Baldia appears to be too summary and uncertain. It is necessary to establish sufficient difference in value between the different qualities to induce the breeder to strive to produce the finest wools. The work of improvement of the stock of sheep in Morocco ought to,rest on the native Providant Societies, the Agricultural Co-operative societies of centres of breeding and mechanical shearing and the " Union Ovine de l'Afrique du Nord ". It would be facilitated by fresh extension of breeding, which allotments of the colonization lots of 2500 ha. arranged by the General Directorate of Agriculture would make possible.

It would be useful to create a post of Veterinary Inspector, whose duty it would be to suggest useful measures and to superintend their execution, and it is important that there should be on the staff of the General Directorate of Agriculture and of the " Service de l'Élevage ", a sheep specialist to assure linking up and continuity of action. In any case, Morocco offers very great possibilities for the rapid development of the stock of sheep not only numerically but also in weight and quality. P. D.

Poultry.

876. **Poultry Breeding.**

WIENINGER (Adviser on Poultry Breeding to the Ministery of Agriculture and Forestry). *Geflügelzucht.* 2nd Edition, pp. 50, figs. 36, Publishers SCHOOTEVERLAG, Vienna 1925.

In this publication WIENINGER, formerly a very successful farmer and cattle-breeder, deals briefly with what a poultry-breeder must know in order to manage his breeding successfully and profitably. The book contains practical directions for the construction of poultry houses and utensils by the use of simple expedients, suggestions with respect to diseases, organisation of marketing and the economical importance of poultry-

breeding. Artificial incubation and breeding, control of trap-nests, and the keeping of accounts are briefly treated, also the more important breeds of poultry found in Austria.

H. K.

877. **Selection of Poultry at the Farm.**

LEGENDRE, G. La sélection des volailles à la ferme. *Revue de Zootechnie, La revue des éleveurs*, Year 4, No 4, pp. 288-293. Paris, 1925.

The author discusses the question of selection of poultry at the farm and remarks that the best birds both as parents and as layers should be hatched earlier than they ordinarily are in the country: for cocks the earlier the better; for heavy hens, hatching in March should be sought, for light hens about the 15th April.

This principle being settled, the fowls can then be selected, the best chosen and the flock improved by eliminating inferior fowls. These two methods combined will give the high yield desired. A preliminary examination will enable all the birds with evident signs of unsuitability to be eliminated; this done only strong, healthy, anatomically well formed birds with compact plumage are kept for more searching examination. It is also desirable to have birds of the same type, giving homogeneous products of good quality, easier to sell and more profitable.

So far, selection has been based on elimination of the unsuitable. It is next necessary to consider what production is more specially aimed at; eggs or poultry for the table, for selection may differ according to one or other of these special objects. Selection will be based on appreciation, a method relatively lacking precision, but by far the most economical and capable of bring most serviceable to the farm.

Appreciation as regards egg production will take place at the commencement or decline of laying, never during its greatest activity; the early laying hen and the late laying hen should generally be kept, for often when the laying period is long the egg production is abundant.

A lively and sprightly external appearance of the bird, the colouration of the comb and gills indicate laying hens or hens about to lay, and spirited cocks. Among fowls which show these symptoms late, those which have the pelvis bones wide apart and supple should be kept; when laying commences these characters have less importance. Generally a good laying hen has a fine skeleton, the feet wide apart and neat, the body long, unless this is contrary to the type.

The secondary sexual characters (spurs, comb) should be well developed, and the colour of the skin and feet noted; handling will enable the birds to be judged for table purposes; the breastbone especially should be well covered.

Cocks should be kept whose sisters are good layers and whose brothers have been early in growth and have put on flesh.

The appreciations on which selection is based if taken singly are subject to doubt, but taken together give sufficient probability.

[877]

The author suggests the following table of marking of points:

		Appreciation	Control	Total
The bird	Vigor . 20	Nervous organization. . . . Width and depth of brest 10	Regular rhythum of laying % of fertility	50
	Type . 20	Standard		
Its products	Eggs. . 10	Conformation. . . . . Texture. 20	Ancestors . . . . . . Individual.	50
	Flesh . 10	Handling . . . . Colour.	Earlines of development Weight	
			Total . . .	100

The systematic application of these methods, supplemented when possible by exact data, will enable poultry to be judged, not by vague appearances, but by indications of their real value and will be the means of rapidly raising the value of poultry by making them more productive.

P. D.

Pisciculture.

878. **Pond Fertilising.**

DEMOLL, R. (Professor University of Munich). Teichdüngung. *Handbuch der Binnenfischerei Mitteleuropas*, Vol. IV. Stuttgart, 1925.

In this book, which for the first time comprises pond-fertilizing as an independent section, the studies on the importance of the soil for the problem of pond-manuring are of a special interest. According to DEMOLL and his collaborators, pond-water should not in the future be considered as a solution of pond-soil. The latter has its own chemistry and physics, and there also arise many differences between the methods of agricultural chemistry and those of the science of pond-manuring (chemistry of hydro-culture). Especial difficulties are found in the taking of samples. The soils employed for experiments in soil-manuring should not be very permeable to water and must not be acid. Moreover the changes must be taken into account which the pond-soil undergoes as a consequence of the introduction of spring or brook water. Thus in the course of years there is a tendency for an equilibrium to be established amongst different soils and the permeability of the soil diminishes as a consequence of the accumulation of settling colloids. The colloidal nature of an old pond-soil mud is considerably greater, according to BREEST and LANTZSCH, than that of the best arable soils.

The nitrogen content of non-nitrogenous pond-soils manured with phosphates, has proved higher than that of not manured pond-soils and exceeds that of all normal arable soils. According to LANTZSCH the nitrification is checked in the upper mud zone of the ponds, but goes down to a soil depth of about 40-42 cm. Deep ploughing of pond-soils has not given good results, because a subsoil poor in organisms is brought to the surface. The necessary loosening of the soil is already brought about by

the freezing of the pond soils in winter and by processes of fermentation which take place in early spring, and also by the organisms working upon the soil. Improvement of a " sick " pond soil is obtained by letting the soil lie fallow during the summer or by the agricultural use of the dry soil. Soils " tired ", in the sense of pond culture, are more profitable for agriculture than normal arable soils.

The methods of valuation of pond-soils are dealt with in the new book. The value of soil appraisement on the basis of its capacity for fixing nitrogen is acknowledged, but the soil should only be valued after it has been adequately limed. The most suitable application of lime was found to be 5 000 kg. $CaCO_3$ per hectare. The latest results reported of pond soil liming are astonishing. While up to this time manuring experiments with 40 per cent. potash salts gave no result. DEMOLL, has of late obtained good yields with kainite and sulphate of potash and magnesia. Phosphoric acid is very strongly absorbed by pond soils, but BREEST found phosphoric acid in the water immediately above the soil, in a very dilute condition. The after effects of former manuring with phosphates have proved to be considerable.

Sulphate of ammonium has recently given good results.

Organic manures should not be closely spread over a pond soil, as they may easily cause an injurious consumption of oxygen. H. F.

FARM EGINEERING.

Hydraulics and Methods of Cultivation.

879. **Power for the Farms from Small Streams.**

DANIELS, A. M., SEITZ, C. E. and GLENN, J. C. *United States Department of Agriculture, Bulletin No.* 1430, pp. 34, figs. 40. Washington, D. C., 1925.

The purpose of the Bulletin is to acquaint farmers with the possibilities of developing the power of small streams by converting it into electrical energy, and the uses to which such power can be put. Information is given as to avoidance of unnecessary expense, the estimation of the available power of a stream, and sources from which additional information may be obtained in regard to approximate cost of installing a plant.

W. S. G.

880. **The Spacing of Crops.**

PRESCOTT, J. A. Bulletin No. 22. *Sultanic Agricultural Society*, pp. 64, tables 26, figs. 22. Cairo, 1924.

The author describes in detail experiments on the effect of spacing on maize, wheat and cotton.

In the competition between plants of the same kind, the volume of soil occupied by the roots may be considered as the principal variable factor affecting yield.

Another possible factor is apparently the effect of the crop on the production of nitrate in the soils, so that less plant food is available at the closest spacings.

Where the yield is built up over a period of time, as in the case of the flowering habit of cotton, or the tillering habit of wheat, the earliness of the crop is also affected; in the case of cotton with very important consequences on account of the pink bollworm attack.

On the whole, the best practical conditions are those which permit of as wide spacing as is possible consistent with yield, as this ensures economy of seed and ease in cultivation and harvesting.

W. S. G.

CURRENT NOTICES

Legislative and Administrative Measures.

881. **Chile : Regulations for the Sale of Nitrate of Soda.** — In reference to art. 14 of the regulations for the application of Law 98, of 14 November 1924, on the control of the sale of fertilisers, an article which enacts that Chilean saltpetre must not contain less than 95 % of nitrate of soda and not more than 2 % of sodium chloride, the " Junta de Gobierno " enacts that in the case of lower percentages of nitrate the market price of the fertilizer shall be reduced: one per cent for 94 % of nitrate, 3 % for 93 % of nitrate, 4 % for 92 %, 6 % for 92 to 91 % and 8 % for a percentage of 90. If the content of nitrate is less than 90 %, the reductions are to be doubled in each case proportionately. The fractions of a unit are to be calculated proportionately. (*Boletin de las Leyes y Decretos del Gobierno*, February 1925 and *Boletín mensual de la Asociación de Productores de Salnitre de Chile*, Vol. VII, No. 74, 1925).

882. **Chile : Regulations for Advances of Seeds.** — This regulation has been passed for the application of the Decree Law No. 851 of 12 February. The Department of Agricultural Services (*Dirección General de los Servicios agricolas*) through the medium of the Publicity and Propaganda Service (*Servicio de Divulgación y Propaganda*) and with the assistance of the provincial and departmental agricultural experts and of a Committee appointed for the purpose, has drawn up a list of small cultivators, owning not more than 100 hectares of land and growing wheat and barley, who require advances of seeds for sowing and who reside in the departments extending from Serena, on the north, to Vichueuen, on the south, for the coast zone, including certain sections of the departments of Combarbala, Putsendo and Melipilla, and if required other departments or sections to be designated by the Minister of Agriculture.

The regulations contain detailed provisions for procedure in the case of advances of seeds. The seeds will be supplied by the special Committee mentioned in the law, and the seeds must satisfy the following conditions: minimum purity, 27 % ; germination, not less than 95.5 ; weight per hectolitre, not less than 70 kg. for wheat and 68 kg. for barley. The analyses are carried out by the Service of Plant Hygiene (*Servicio de Policia Sanitaria Vegetal*) and the *Servicio de Divulgación y Propaganda* is responsible for inspection. (*Boletín de la Sociedad Agricola del Norte*. Year 15, No. 2, La Serena, 1925).

883. **Esthonia : Importation of Live Cattle and Animal Products.** — These imports must be accompanied by a certificate given by a veterinary

practitioner of the exporting country, appointed officially by the Government in question. The certificate must state that the import to which it refers comes from a country where no case of infectious disease of cattle has been reported during the last fortnight. In the case of non-observance of this regulation the Service of Control of Animal Hygiene of Esthonia may send back the cattle or animal products respectively, which it is desired to import, to the country from which they come, or even, in more favourable circumstances, may order the quarantine of the animals and the disinfection of the products in questions. (*Communication of the French Legation in Esthonia to the French Ministry of Commerce and Industry*). (Appendix to No. 13 of the *Moniteur Officiel du Commerce et de l'Industrie*).

884. **Belgium and Luxemburg : Excusing of Certificate of Origin in the case of the Superphosphates of the Economic Customs Union of Belgium and Luxemburg imported into France.** — Following on the conclusion of the commercial agreement between France and the Economic Customs Union of Belgium and Luxemburg, signed at Paris on 4 April 1925, there are included in the list of the goods excused the certificate of origin at the time of their export from Belgium and from Luxemburg into France, superphosphated originating in the Union above mentioned, if imported in sacks bearing manufacturers marks, from either Belgian or Luxemburg. — The French Customs Department reserves the right to obtain legal advice when there is occasion to suspect the origin of the superphosphates.

885. **France : Supervision of the Production of Silkworm Eggs.** — By the Decree of 25 May 1925, which modifies preceding decrees, the establishments for production of silkworm eggs must give notice to the Ministry of Agriculture, Office of Agricultural Information (*Office des Renseignements agricoles*) of the particulars relating to their commercial and industrial standing (entry number on the Register of Commerce, office address, exact location of the establishments, etc.). The importers of silkworm seed must give the proper notice to the inspector of the supervision service at Dreguignan, of their name and address, the place where the imported seed is stored, its total weight, the number of the packages of the different kinds. The inspection service shall proceed to the proper examinations and shall subsequently affix a suitable mark to the actual packages which contain the seed, which is to be placed on the market. (*Journ. Off.*, May 1925).

886. **Ivory Coast : Control of cotton, rubber, rice, kola nuts and bird lime.** — In the *Journal Officiel de la Côte d'Ivoire* (March 1925) there are published the Governmental Decrees establishing control of the sale, purchase and export of these products.

887. **French West Africa : Breeding of Merino Sheep in the Haute Volta.** — A provisional grant of land has been made by decree to the Tourcoing Chamber of Commerce for the purpose of breeding merino sheep. The land is about 500 hectares in area and is situated to the east of the Bame Lake (district of Cuahigouya). (*Journal Officiel de la République française*, 9 January 1925).

888. **Latvia : Fund for Seeds.** — A fund of 500,000 lats has been instituted with a view to obviating any shortage of seeds and to improving their quality. Selected seeds are to be supplied to cultivators in the form of advances, such

seeds being suited to the climatic conditions of Latvia. In the event of there being an insufficiency of these seeds, seeds of ordinary quality are supplied instead, which must however satisfy certain requirements made by the Ministry of Agriculture. Seeds purchased with the fund so set aside are distributed in the first place to the owners of recently formed holdings, then to the small cultivators and the bee-keepers who were ruined by the war. The fund for the seeds is intended also to meet any shortage of seed due to poor harvest, damage from hail, etc.

The Ministry of Agriculture has the administration of this fund and fixes each year for every farm holding the quantity of seeds which it has the right to receive. Besides repaying the cost price of the seeds (including the cost of transport, etc.) the farmer has to pay 2% of the price so as to secure the stabilization of the fund. Individual advances of seeds can only be made for a period of one year in the case of spring sowings and of 18 months for the autumn sowings. (*International Institute of Agriculture, Legislative Texts* No. 3, 1925).

889. **Luxemburg : Importation of Oats for Sowing.** — The Grand-Ducal Government, Department of Commerce and Industry, issued last spring the following instructions for the services subsidiary to the Customs: 1. the importation of oats for sowing is limited to the first four months of the year; 2. the oats must be in bags sealed with the seal of the producer and of the agricultural organization to which he belongs, and must be accompanied by a certificate of origin, placed inside the bag, stating that the contents are selected seeds. This certificate of origin is not merely a Customs formality, but is to be given by the Seed Selection Stations. (Communication made by the French Ministry of Commerce and Industry. Appendix to No. 13 of the *Moniteur Officiel du Commerce et de l'Industrie*, 1925).

890. **Rumania : Testing of Seeds of Forage Plants.** — Regulations have been issued for the application of the law to the trade in seeds of forage plants belonging to the families of the Leguminosae and of the Gramineae. The testing is carried out by the Bucharest Central Agricultural Station, by the Agricultural Station of Cluj, by that of the North and by any other stations to be set up by the Ministry of Agriculture and Public Lands. The conditions which must be fulfilled by seeds for marketing relate to purity, germinative power, freedom from dodder, kind and variety, place of origin. A maximum of 2 % of foreign bodies is tolerated. The tests for germination, which are carried out on 100 grains of pure seeds, must be continued for 10 to 12 days in the case of white clover and alsike and for the grasses *Lolium perenne*, *Lolium italicum* and *Phleum pratense* : ten days for red and crimson clover and lucerne, and from 15 to 27 days for the other seeds.

Seeds may only be placed on the market in sound bags accompanied by a certificate of analysis, and in the case of clover seeds, or seeds of lucerne, *anthyllis vulneraria*, *lotus corniculatus* and *phleum pratense*, also sealed. Seeds left unsold at the end of a year must be subjected to fresh tests.

The regulations in question refer to the measures concerning the procedure to be followed for seed testing, both on the side of the agricultural stations, and on that of the seller and the purchaser. In order to secure the destruction of dodder in the fields, State supervision of the forage crops in question has

been established ; the inspections take place at least twice a year, viz., after the first cutting and during the autumn. The owners of crops of lucerne, clover, etc. are obliged to destroy the areas infected with dodder.

The importation of forage seeds not first subjected to the analysis of the Bucharest Agricultural Station is forbidden and these imports are as a rule limited to the Customs Offices of Halmi, Timishozsa, Arad, Chica-Voda, Galatz, Sibiu, Costanza, Bucharest. The regulations lay down the procedure to be followed in such cases, and the penalties for contravention of the provisions. (*Correspondance économique roumaine*, Year VII, No. 1).

891. **Rumania : The New Wheat Flour and Bread Regulations.** — In accordance with the orders issued by the Rumanian Government in February last to meet the requirements of bread-making, rye, barley and their derivatives were stated to be articles of prime necessity for the feeding of the population and in consequence their export was forbidden. The mayors of the urban communes were empowered to authorize the making of bread with whole wheat flour mixed with the flour of potato, rye, maize, barley, and moreover in case of need to fix the days of the week on which the feeding of the population was to be secured by means of maize flour. The price of rye and its derivatives was fixed by the Government, while that of barley and barley flour was left free. (*Journal*, No. 600, February 1925 and *Correspondance économique roumaine*, Year VII, No. 1, 1925).

892. **Rumania : Institution of Agricultural Chambers.** — Departmental Agricultural Chambers have been instituted in Rumania by a special law, with headquarters in the chief towns of the districts, and grouped into a " Union of Agricultural Chambers " with headquarters at Bucharest. They are public institutions, founded for the purpose of representing and safe-guard ing the interests of agriculture, forestry and stock breeding in their various branches, and of contributing in every way to the increase of production in the various spheres, whether of agriculture, forestry or stock breeding. The Law which relates to these Chambers is divided into eight chapters : foundation and objects ; constitution of the district Chambers ; constitution of the Union of the Agricultural Chambers ; organization of the Chambers; budget and management ; general provisions ; temporary provisions. (*Correspondance économique roumaine*, Year VIII, No. 1, Bucharest, 1925).

Experiment Stations and Agricultural Instruction.

893. **Germany : Experimental Stations at Lauchstadt and Gross-Lubars.** — Prof. W. SCHNEIDEWIND has compiled in collaboration with Drs. F. MÜNTER and J. HAHNE and the administrator W. GROBLER, two detailed reports on the activity, during the period 1916 to 1923, of these two experimental stations, belonging to the Agricultural Chamber of the Province of Saxony. The reports deal with numerous enquiries on fertilising, and cultivation experiments (wheat, barley, oats, lupins, peas, kidney beans, potatoes, sugar beets, etc.). The work contains a large number of tables giving numerical data. (Prof. Dott. W. SCHNEIDEWIND. Neunter Bericht über die Versuchswirtschaft Lauchstadt und zweiter Bericht über die Versuchswirtschaft Gross-Lubars. *Landwirtschaftl. Jahrbücher*, Vol. LXI, part. 5. Berlin, 1925).

894. **Germany: Experimental Forestry Institutes.** — On 24-25 March 1925, after 12 years interval, the association of these institutes (*Verein der Deutschen forstlichen Versuchsanstalten*) resumed its meetings at Weimar. The last general meeting had been held at Neustad on the Hardt in 1913. At the present meeting representatives were present of the experimental institutes of Bavaria, Prussia, Saxony, Baden and Hesse. Apologies were made for the absence of representatives of those of Wurttemberg and of Brunswick. Thuringen does not yet possess a forestry institute. The next general meeting will be held in the spring of 1926, probably at Konigsberg. (*Forstwissenschaftliches Centralblatt*, Year 47, No. 11, Berlin, 1925).

895. **Germany: Courses in Rural Mechanics in Bavaria.** — The Bavarian Government about ten years ago instituted agricultural chambers in various places (*Landwirtschaftsstellen*), which encouraged agricultural progress and served as advisory bodies for agriculturists. There are at the present time 98 of these organizations, including in round figures 200 special advisers who act under the Bavarian Ministry of Agriculture. The Ministry in 1920 arranged that the *Landwirtschaftsstelle* should hold, so far as possible every year, courses of practical rural mechanics for the benefit of the cultivators of small and average sized holdings, adapted to local requirements in each case. Accordingly, the Ministry of Agriculture merely laid down in this connection the main outline of the scheme, leaving it to the *Landwirtschaftsstelle* to carry out the special applications in the different courses. Side by side with the theoretical instruction on farm implements and machines, care is taken to give the students practical acquaintance with their working, the putting together and taking apart of the machines and their separate parts. The courses are accordingly held in connection with visits to an agricultural machinery factory and a large repairing workshop, etc. where expert foremen give practical illustrations to the students as required. A visit to some large farm completes the courses.

So as to ensure success not more than 15 to 20 persons are admitted to the courses and in case of need, the courses are repeated with the same students. As a general rule, the instruction lasts for a week, usually fixed for the second half of May, a time when farmers are relatively at liberty. The following are the statistics of attendance, etc., for the years 1921-22-23-24. In 1921 32 courses were held by 27 *Landwirtschaftsstellen*, attended by 570 students; in 1922, 57 courses by 47 *Landwirtschaftsstellen*, attended by 815 students; in 1923, 70 courses by 58 *Landwirtschaftsstellen*, attended by 1315 students; in 1924 there were held 59 courses, arranged by 51 *Landwirtschaftsstellen* with 1058 students. (Fr. LANG. Landwirtschaftliche Maschinenlehrkurse in Bayern. *Münchner Neueste Nachrichten*, 17 June 1925).

896. **Austria: The Fiftieth Anniversary of the Experimental Forestry Institute of Mariabrunn.** — The separate official existence of an Experimental Department for Forestry (*Versuchsleitung*) in Austria dates back to 9 July 1874 when by decree of the Ministry of Agriculture in Vienna there was appointed a temporary director for forestry enquiries, and by the subsequent Imperial order of 2 August 1874 the whole subject was brought under regulation. The first Director for Experimental Forestry (*Leiter des forstlichen Versuchswesen*) was Prof. ARTHUR Baron VON SECKENDORFF-GUDENT, who was already since 1868 a member of the Forestry Academy of Mariabrunn,

and who in the twelfth year of his holding of the post of head of the Department (1874-1886) had as collaborators F. A. WAGHTL, J. MOLLER, V. HOHNEL, O. SIMONY, V. THUMEN, W. VELTEN, N. BOHMERLE, A. CIESLAR, and others. The activity of this highly competent group of persons took the form of over 100 scientific works, published partly in the *Mitteilungen aus dem forstlichen Versuchswesen Oesterreichs* partly in the *Centralblatt für die gesamte Forstwissenschaft*.

After the death of SECKENDORFF which took place on the 29 November 1886, the Chief Forest Councillor LUDWIG DIMITZ was appointed *Versuchsleiter*, but on being subsequently transferred to take charge of the Technical Forestry Service in the Ministry of Agriculture, he was replaced (December 1888) by JOSEF FRIEDRICH, also Chief Forestry Councillor. Under FRIEDRICH, the *Versuchsleitung* was transformed in April 1891 into an Experimental Forestry Institute (*Forstwirtschaftliche Versuchsanstalt*) and the work was carried on by the director in conjunction with WACHTL, CIESLAR, BÖHMERLE, the future successor of FRIEDRICH, A. SCHIFFEL, HOPPE, N. v. LOERENZ, P. v. RUŠNOV, HADEK, JANKA, W. SEDLACZEZ, ZEDERBAUER. SCHIFFEL who held the direction of the Institute from 1908 to his retirement in 1911, was succeeded temporarily by HADEK and then by KUBRIKA till the outbreak of the war: during the war H. LORENS LIBURNAN was elected to the post, and after 1918 when the Institute of Mariabrunn was no longer part of a great State, for that reason and from other circumstances it began to undergo certain changes in its constitution. After the directorship of JANKA (1919-1922) and in consequence of the appointment of ZEDERBAUER to the Vienna Higher School of Agriculture (Hochschule fur Bodenkultur) the vacant post was not filled and from that time the direction has been carried on by an official of the Institute. In the fifty years of its existence, the Mariabrunn Forestry Institution has published about 400 scientific works. (*Centr. f. d. Forstwesen*, Year 50, Parts 7-12, Vienna and Leipzig, 1924).

897. **Belgium: The Mechanical Laboratory of the Non-State University of Solbosch, Brussels.** — In consequence of the munificence of the family of ERNEST SOLWAY, the course of study, which leads to the new degree of Electro-technical Engineer, will be completed by experimental researches. The object of the new laboratories will be threefold: 1. to enable the students to acquire the necessary practical knowledge of technical measurements under the conditions in which they will be found in industry: 2. to facilitate the systematic study of the machines and to make possible a thorough acquaintance with their working; 3. to make it possible to undertake, side by side with the teaching exercises, research and experimental work, suggested by engineers and builders, which may offer scientific interest or some new feature.

The equipment of the laboratory will include four groups of installations: Heat technique; Thermo-mechanics; Hydraulics and Mechanics of Gases; Dynamometry and General Mechanics (*Revue générale du froid*, No. VI, Vol. VI. No. 4, 1295).

898. **Brazil: Agricultural Experiment and Instruction during 1924.** — Experimental Stations. — The General Experimental Station of Campos (*Estação Geral de Experimentação*) is pursuing its inquiries on the varieties of sugarcane. By hybridization more than 5000 different varie

ties have been obtained up to the present, many of which have been rejected others are under investigation and some are being cultivated for subsequent distribution among planters. Research has been made on the sugar content and purity of the juices of the different varieties and the influence of fertilisers in this respect is being demonstrated. Experiments on the " Uba " cane, the resistance of which to certain diseases, mainly to " mosaic ", is well known, have led to the obtaining of valuable varieties, with longer internodes and larger diameter than the species from which it originates.

The abnormal situation in Rio Grande do Sul makes it difficult for the work of the General Experimental Stations to be extended more than in past times.

The " Section of the Sugar yielding and Oil yielding Plants " of Conceição do Arroio has at its disposal a million square metres of which 225,000 are pasture land and the remaining are under cultivation of various kinds, especially sugarcane. In the year 1924, no less than 3,308,410 seedlings of sugarcane were distributed.

The Alfred CHAVEZ Wheat Section has harvested in all, 20,742 kg. of selected wheats, rye, oats, barley.

The Goytacazes Experimental Station is in process of final organization.

Botanic Garden. — Researches were continued, in the Botanic Garden, on the flora of the country, with special economic objects and excursions taken when necessary to the more interesting districts in this respect. A careful survey has been made of the Amazon region, from the point of view of its climatology and ecology as well as the botany. A large number of living specimens and seeds have been brought back to the Botanic Garden, and valuable results obtained. Great advantage will result from the formation of smaller botanic gardens in the different States with the view of proceeding to the planting and cultivation of regional kinds of plants of economic value, and especially of those threatened with extinction. The Botanic Garden, in 1924, distributed a large quantity of plant specimens and 423 kg. of seeds.

The Biological Station of the Forest Reserve (*Estaçâo Biologica da Reserva Florestal*) of Itatiaya has made progress in carrying out its programme of work and enquiry relating to the flora of the mountainous regions, especially in regard to forestry.

From year to year there is an increase in the exchange of publications, seeds, vegetable products, etc., between the Botanic Garden and other institutions of the kind, European and American. The Garden issues its own records on its original and unpublished work on the Brazilian flora.

Higher School of Agriculture and Veterinary Medicine. — The school has not yet the use of adequate land for demonstrations and experiments and hence is unable to carry out all its practical work.

Barbacena Sericultural Station. — This institution also is in need of a larger area and more plants. In 1924 it distributed 51,755 mulberry plants and 1567 grammes of silkworm seed.

Propaganda by means of co-operative Research. This is carried out by the Department of Agricultural Development (*Directoria do Fomento Agricola*). The farmer's share in the co-operation is the land,

the management, the labour, the live stock, etc. and that of the Government includes the machines, seeds, fertilisers, insecticides, etc. as well as expert assistance. The crop is solely for the benefit of the farmer ". (N. D. R.). There are 138 of these plots, working under the Ministry of Agriculture, with a total area of 721 hectares, and distributed as follows: Amazonia, 4; Parà, 5; Maranhão, 4; Pianhy, 3; Ceará 9; Parahyba, 3; Pernambuco, 2; Alagoas, 5; Sergipe, 5; Bahia, 4; Espirito Santo, 3; Rio de Janeiro, 21; Minas Geraes, 10; San Paolo, 21; Paraná, 3; Santa Catharina, 9; Rio Grande do Sul, 12; Goyaz, 5; Matto Grosso, 7; Territorio do Acre, 2.

Agricultural Apprenticeship Courses. — These apprenticeship courses (*Aprendizados agricolas*) have been in regular working at Barbacena and Satube. The pupils on leaving readily found post at the agricultural inspectorates of the different States. At the Joazeiro courses 1072 plants were distributed, nearly 16 kg. of seeds and 990 layer shoots of vines of different varieties. During those held at São Francisco there were carried on cultivations of millet, sugar cane, rice, beans, tobacco, cassava, sweet potato, banana, etc., large quantities of seeds being also distributed to those taking part. On the other hand the courses at S. Luiz das Missões have not been held regularly, on account of the revolutionary situation in Rio Grande do Sul. (Mensagen apresentada ao Congresso Nacional na abertura da segunda sessâo da decima segunda legislatura pelo Presidente da Republica ARTHUR DA SILVA BERNARDES, 1925. *Diario Official*, May 1925).

899. **Bulgaria : A New Stock Breeding Station.** — The Sofia Departmental Council has organized this new station, for which the bishopric of Sofia has granted the buildings of the former monastery of Chiiakovo. There will be established a depot for stock breeding, an experimental farm and a farm for the production of different seeds of agricultural value. (*La Bulgarie*, Year 2, No. 573, Sofia, 1925).

900. **China : The Ling Nan Agricultural College, Canton.** — *The ingnaam Agricultural Review*, Vol. II, No. 2, 1925, contains an account of r ecent work carried out by the Ling Nan College in animal husbandry, agronomy, horticulture and sericulture. Rice is being closely studied and over 100 varieties of this cereal have been introduced from the United States, the Philippines, Java and Japan. Allusion is made to the insecticide DERRIS, known as tuba root in the Straits Settlement; near Macao gardens are kept free of insect pests by the use of this insecticide; the College has obtained about 2000 plants in order to study its properties.

901. **China: The College of Agriculture and Forestry, University of Nanking.** — The tenth annual report of this College states that there has been a large increase of teachers, associates and assistants. All investigation work, both scientific and practical, has been considerably extended. The annual grant of 5000 dollars from the Shanghai Forestry Fund Committee has been renewed for another period of three years. An agricultural and forestry periodical has been successfully published. Equipment for class, laboratory and field use has been added. The year's work in sericulture, cotton and cereal improvement has been highly successful, and direct contacts with the farmers have been greatly increased.

The University of Nanking through the College of Agriculture is pressing

for ward its ten years' famine prevention programme, for which it has a fund of 675,000 gold dollars, allocated by the American Committee for th eChina Famine Fund of New York.

This College has now eleven departments: Agricultural Economics and Farm Management, Agricultural Gardens, Agronomy, Bacteriology, Botany, Cotton Improvement, Forestry, Plant Pathology, Rural Education and Sericulture. (*The Lingnaam Agricultural Review*, Vol. 2, No, 2 Canton, 1925).

902. **China: Agricultural Education at Peking University (Yenching).** — The Department of Agriculture is now well organized and in the 1924-25 programme courses were announced in the sections of Agronomy, Horticulture, Agriculture, Animal Husbandry, and Poultry Husbandry. Additional courses are offered in problems of Chinese country life and sources of agricultural information. Students taking these courses are eligible for the Degree of Bachelor of Science. Yenching is especially interested in animal industry, and pure-bred beef and dairy cattle are being imported from America. Professor Bransford Eubank, a graduate of the Texas Agricultural and Mechanical College, is to take charge of this work. (*Lingnaam Agricultural Review*, Vol. 2, No. 2. Canton, 1925).

903. **United States: Annual Report of the Agricultural Experiment Stations, University of Louisiana, 1923.** — The field work at Audubon Park has been transferred to Baton Rouge where about 100 acres are available for sugar cane studies. Experiments were made on cane land with a new "clover", *Melilotus indica*, which provided 107 lb. of nitrogen in the soil per acre. A very severe outbreak of borers was experienced in the cane fields; attempts to render the egg parasite of the moth borer more efficient were unsuccessful, The tachnid introduced from Cuba was found on 16 plantations, but no effect on the prevalence of borers was observed. Dipping canes into water heated to 50°C. proved effective against the moth borer and the mealy bug; no harm was caused to the buds of the cane when they were in the resting condition. Moth borer caterpillars were found feeding on several species of wild grasses.

Moulds responsible for deterioration of sugar in storage were found to be susceptible to carbonic acid gas, and the introduction of a non-sporulating yeast Toruba, which gives off quantities of this gas gave satisfactory results.

904. **United States: Tropical Plant Research Foundation.** — The Tropical Plant Research Foundation is an organization formed under the auspices of the National Research Council and incorporated on June 6, 1924, under the laws of the District of Columbia governing societies for scientific and similar purposes. The objects of this foundation are to promote research for the advancement of knowledge of tropical plants and crops; to conduct investigations in plant breeding, agriculture, horticulture, forestry, agricultural entomology and plant pathology, and to publish the results thereof; it is also empowered to establish and maintain such temporary or permanent stations and laboratories as may be necessary for the accomplishment of these objects.

As a result of a conference of foresters and officers of the Pan-American Union, held on 29 October 1924, the Foundation has been commissioned to collect all available information relative to the forests of Latin America, as a preliminary step towards a Pan-American Forestry Conference, and the outlining in a definite manner of the problems of tropical forestry.

The central office of the Foundation is in Washington. The laboratory headquarters in the United States will be at the Boyce Thompson Institute for Plant Research, Yonkers, N. Y. The administration of the Foundation is vested in a board of nine trustees, four of whom represent business interests, while five must be scientific men. The foundation will work on a project basis definitely organized in turn for each particular problem, such, for example, as the diseases and insects of sugar cane in Cuba, and will provide a research service for tropical plant industries.

The following bodies will be represented on the board of trustees by one member in each case, the National Research Council, the American Phytopathological Society, and the American Association of Economic Entomologists. The foundation will be supported by funds contributed by individuals or organizations interested in tropical plant products.

The Foundation is to assemble records of the researches already carried out and to compile special indexes and bibliographies. There will be established a personal register of scientific men who are particularly equiped for tropical service. The scientific staff is at present composed of the following members : Entomologist, Prof. D. L. VAN DINE ; assistant entomologist, Mr. C. F, STAHL ; Phytopathologist, Dr. JAMES A. PARIS ; assistant pathologist, Mr. Marion N. WALKER ; chemist and soil biologist, Dr. R. V. ALLISON. The advisory committees are : the Division of Biology and Agriculture, National Research Council, the Advisory Board of the American Phytopathological Society, the Committee of Policy of the American Association of Economic Entomologists, and the Executive Committee of the Cuba Sugar Club.

The President of the Board of Trustees is Prof. L. R. JONES, head of the Department of Plant Pathology, University of Wisconsin ; the Vice-President, Prof. R. A. HARPER. Torrey Professor of Botany, Columbia University, New York, and Chairman of the Committee on Biology and Agriculture, National Research Council. As Scientific Director and General Manager has been elected WILLIAM A. ORTON, ex-pathologist in charge, Office of Cotton, Truck and Forage Crop Disease Investigations, Bureau of Plant Industry, United States Department of Agriculture. (*Bulletin of the Pan-American Union*, Washington, D. C. January, 1925).

905. **United States : Study of Ornamental Plants.** — The San Fernando Nursery Company, of San Fernando, California, has established a department of plant research, for the purpose of studying problems of identification, propagation and improvement of ornamental plants. The work has been placed under the direction of Dr. ARTHUR HOUGHTON of the University of California. (*Science*, Vol. LXI, No. 1575, 1925).

906. **United States : Research Fellowship in the Chemistry of Perfumes and Essential oils.** — Through the generosity of Messrs. WATERMEYER and LEONHARDT, president and vice-president of Fritszche Brothers, a fellowship for research in the chemistry of perfumes and essential oils has been offered to Columbia University. The fellow is to be appointed by the University Council upon nomination of a committee of award composed of the president of Fritzsche Brothers and the senior professor of organic chemistry at Columbia, and approved by the department of chemistry. The recipient of the fellowship will receive 3000 dollars per annum and the investigations will be

conducted under the direction of Professor MARSTON T. BOGERT. (*Science*, Vol. LXI, No. 1578, 1925).

907. **United States : Conference on Gardening.** — Dr. A. C. BEAL, Professor of floriculture in Cornell University, delivered last spring a series of six lectures on " The history of gardening and the use of flowers " before the Horticultural Society of New York and the Garden Club of America at the American Museum of Natural History, New York. (*Science*, Vol. LXI, No. 1586, 1925).

908. **United States : University of Michigan Biological Station.** — This Station held its session for instruction and research from 22 June to 14 August on the shores of Douglas Lake, Cheboygan Country, Michigan. The courses in zoology included : ichthyology, limnology, entomology, ornithology, herpetology and mammalogy ; those in botany : taxonomy of green cryptogams, taxonomy of the briophytes, systematic botany, ecology, plant anatomy and plant geography. The various lines of research were directed by : Prof. CARL LA RUE (University of Michigan) for the morphology, taxonomy and life histories of parasitic worms ; Dr. CH. CREREAS (College of the City of Detroit) for fishes and mammals ; Prof. P. S. WELCH (University of Michigan) for aquatic insects and limnological problems ; Dr. F. BLANCHARD (University of Michigan) for birds, amphibians and reptiles ; Prof. HUNGERFORD for aquatic hemipters ; Prof. G. E. NICHOLS (Yale University) for the bryophytes ; Prof. GATES (Kansas State Agricultural College) for plant physiology and ecology ; Prof. EHLERS (University of Michigan) for the taxonomy of the flowering plants. (*Science*, Vol. LXI, No. 1575, 1925).

909. **Transfer of the Collection of Type Cultures of Bacteria of the American Museum of Natural History to the McCormick Memorial Institute of Chicago.** — This large collection of type cultures of bacteria established at the American Museum of Natural History by Dr. C. E. A. WINSLOW, and more recently maintained at the Army Medical Museum by the Society of American Bacteriologists has been transferred to the McCormick Memorial Institute in Chicago. This has been made possible by a grant secured by the National Research Council from the General Education Board, which provides for the maintenance of the collection for a period of five years. The general supervision of the collection is vested in a committee representing the Society of American Bacteriologists, the Society of Pathologists and Bacteriologists, the American Phytopathological Society, the American Society of Zoologists and the McCormick Memorial Institute. The committee hopes to enlarge the collection, and eventually to include fungi, moulds and other microorganisms, as well as a comprehensive collection of bacteria. A catalogue will be issued as soon as possible. (*Science*, Vol. LXI, No. 1572, 1925).

910. **United States : Livestock Experiment Station, Miles City, ontana.** — By Act of Congress in April 1924, 55,000 acres of grazing land and 2000 acres of irrigated land, situated in Miles City and formerly occupied by the Fort Keogh Military Reservation, was transferred to the U. S. Department of Agriculture. This area together with the buildings already put up and 75 miles of fencing is now the property of the livestock Experiment station, and under the immediate supervision of the Animal Husbandry Division o the Bureau of Animal Industry, with the co-operation of the Montana Expe-

riment Station and other bureaus and divisions of the department interested in livestock problems. Plans have been made to maintain an initial herd of 1000 beef cattle, and a stock of sheep, hogs, horses and turkeys. (*Science*, Vol. LXI, No. 1575, 1925).

911. **Research on the Applications of Electricity to Agriculture.** — The question of the use of electricity on the farm is one of importance in view of the advantages of this source of energy. However, as regards rural needs, the cost of production is often a relatively small item as compared with the cost of transmission, distribution and transformation. One of the chief difficulties is that the consumption of electrical energy by the average farmer is relatively small. To establish an electrical service the agricultural uses of electricity must be increased, so that a rate can be charged which will be advantageous both to the central station and the farmer.

The following are some of the chief applications of electricity in agriculture: lighting, heating, in the canning of fruit and vegetables and the making of preserves, the dehydration of fruits, the electrical treatment of seed, the stimulation of crop production, increase of egg production, heating of incubators, spraying and heating of orchards to prevent injury by frosts, and as a source of power, both for ploughing and cultivating and for the many machines in use on a farm.

The variable results obtained so far indicate that not enough is yet known about the main factors. The use of electricity generally in farm operations will probably come about from the development of the use of smaller power units.

The scientific application of electricity to agriculture requires a large amount of fundamental agricultural research and also of engineering experimentation, to ascertain power requirements and exact electrical applications. (*Experiment Station Record*, Vol. 51, No. 4, Washington, 1924).

912. **France : Experimental Work in Olive Cultivation, etc.** — J. BONNET, Regional Professor of Oleiculture gives a summary in the *Bulletin de l'Office de Renseignements agricoles* (No. 9, 1925) of the results obtained in the period 1923-25 in the centres of experimental olive cultivation and in the French co-operative oil manufacturies with experiments on olive trees with complete fertilizing, comparative experiments in annual and biennial prunings, the use of baskets of alfa fibre, coconut fibre or of metal receptacles, the effect of adding hot water to the olive oil residues, the effect of the autumnal frosts on the rich flavour of the olives, the picking of the olives, the effect of using oil of almonds in the treatment of the olives, the various operations connected with the pressing apparatus, and experiments with the oil extracted from wine lees.

913. **France : Valuable Collections belonging to the "Laboratoire d'Agronomie coloniale" (Paris) destroyed by Fire.** — A fire which broke out on the night of 6 June last has destroyed the valuable collections and documents belonging to the " Laboratoire d'agronomie coloniale ", which is under the direction of Prof. AUG. CHEVALLIER. The herbariums which contained some very rare plants and flowers have been reduced to ashes, as also the collection of valuable colonial timbers, and in addition more than 20,000 treatises and manuscripts collected during a period of thirty years.

914. **France: The Centenary of the Nancy National School of Waters and Forests.** — *L'École nationale des eaux et forêts* of Nancy, must be regarded as one of earliest of the kind, having been inaugurated on 1 January 1825, in virtue of a Royal Order of 26 August 1824. At that date only three institutions of the same type were in existence: that of Mariabrunn in Austria, founded in 1813, of Aschaffenburg in Bavaria (1820) and of Hohenheim in Wurtemberg (1820). The history of this school has been given in a book by Prof. CH. GUYOT, its former director (CH. GUYOT: *L'enseignement forestier en France. L'École de Nancy*. Nancy, 1898). In 1825 the first director of the school was an expert of great repute in forestry, LORENTZ, who was also for many years the only professor. When he was made administrator of forests at Paris, his place at Nancy was taken by DE SALMON, who was succeeded in 1838 by PARADE, the son-in-law of LORENTZ, who remained in office for nearly 26 years, and gained the reputation of being one of the greatest forest experts in France: on his death, which occurred in 1864 NARQUETTE was elected as director, and was succeeded in 1880 by PUTCH. The subsequent directors were BOPPE, GUYOT, and VIVIER and at the present time GUINIER.

The Forestry School of Nancy has the use of its own forests for the practical training work of the students. It has exclusive rights of enjoyment of those in the Vosges, in the Pyrenees and also in other parts and for a total area of some thousands of hectares. The students are boarded during the time of their studies and have to reside in the school buildings. They receive a compulsory military training and on leaving the school, are regarded as State functionaries with a right to pay. (*Journal Forestier Suisse*, Year 76, No. 7. Berne, 1925).

915. **France: Instruction in Poultry Keeping.** — In an article, entitled *Nécessité de l'enseignement avicole*, which appeared in the *Revue Avicole* of last May, Ch. VOITELLIER, Professor at the *Institut National Agronomique*, explained the bases on which modern instruction in poultry keeping should be given in France. After having dealt with the present state of French poultry production, taking it in comparison with the production of the other European countries, and after suggesting the principal methods for its improvement and increase, he gives the main heads of the essentials of a regional instruction in poultry-keeping. In addition to the study of the early methods known to many people but not enough known in the country districts, of natural hatching of special incubation, of breeding, of fattening, he advises attention to the following: The management of country poultry yards, based on the utilization of hens which have a high egg-laying capacity; the elimination of the poor layers, the introduction of fowls that satisfy the conditions necessarily imposed for egg-laying, during the bad season; feeding on the lines required for the needs of laying hens; selection based on the use of the trap-nest, on production tests, as also on egg-laying; the weeding out of fowls i. e. the getting rid of the poor layers, choice of favourable times for the hatching according to the different breeds; the rearing of pullets with a view to egg laying; the production of non-fertile eggs for purposes of consumption; the methods of obtaining a high percentage of fertility in selected breeders: the value of the breed and the results of selection among families with a maximum egg-laying capacity; employment

of different systems of incubation and rearing; production of ducks' eggs: principles of feeding according to district; disinfection procedure; treatment of infectious diseases.

Prof. VOITELLIER further considers it essential that every experimental stock-breeding centre should have a poultry-keeping scheme, and in default of this that centres should be formed of experimental poultry keeping. The co-ordination of the results of the experiments and of the inquiries undertaken at these centres of investigation should be effected by a higher technical office which would serve as a link between the Department of Agriculture and the holders of the chairs of applied sciences whether of the Institute of Agronomy, the national schools of agriculture, or the veterinary schools. It is also essential that the professors and lecturers should be able to point to practical examples of poultry yards managed in accordance with the principles they are advocating. Professor VOITELLIER finally urged that attention should be given to the training of instructors specialized for the teaching of poultry management, on the lines of the diploma of *Conférencier avicole*, or Poultry Adviser as in England, Belgium or Denmark, and that use could be made also for such a purpose of the mistresses in charge of the household management instruction in the country districts. (*La Revue avicole*, Year 5, No. 3, 1925).

916. **France: Experiments in Sericulture.** — The Director of the *Station séricicole du Var* has published a report on the enquiry into the silkworm breeding carried out in 1923-24 by the *Station séricole de Draguignan et établissements en dépendants*. Researches have been made on the basis of the Mendelian law and with the result that after a year of strict selection breeding there has been a considerable improvement in the yield in spinning and in the quality of the silk. Other enquiries into the comparative value of leaves of mulberries grafted or otherwise went to prove the superiority of the former both for rearing the worms and as regards yield per tray. In addition, comparative experiments have been made in rearing with the mulberry branch as compared with the separate leaves, as practised in Italy by the Lombard and the Friulian systems respectively. Rearing on the branch, according to the results obtained in the Draguignan Station, cannot be usefully practised except in districts where the foliage is abundant and the trees are not exposed to frosts, while it cannot be in any way recommended in districts where silkworms are reared for reproduction from seed, in which there is a general shortage of foliage and when healthy and strong cocoons are wanted. Mme. BECU, the directress of the Luc *Station expérimentale de grainage*, who had undertaken similar researches on the suggestion of BRANDI, concurs with these results. It is the opinion of this lady that in districts where breeding is carried on for the silkworm seed industry rearing on separate leaves is preferable, while rearing on the branch may be useful for the production of cocoons for spinning. (*Bulletin de l'Office de Renseignements agricoles*, No. 9, 1925).

917. **France: Diploma of Expert Producer of Silkworm Seeds.** — Following on the resolution of the French Union of Producers and Exporters of Silkworm Seed, at its meeting on 26 March 1925, the Minister of Agriculture, by decree of 28 April (*Journal Officiel*, 30 April), has instituted this diploma, to be granted to persons who prove that they possess a sufficient range of know-

ledge for the complete production of pure and selected silkworm seeds. In order to obtain a diploma the candidate must take a written examination in the following subjects:

Anatomy, physiology, metamorphoses, reproductive functions of the silkworm; structure of the eggs, study of external influences, preservation of the eggs, incubation, hatching; pathology; disease symptoms, causes, remedies, special study of pebrine, flacherie, wasting, etc., Pasteur treatment, silkworm rearing, genetics, removal of the cocoon, methods of breeding, selection from the point of view of abundant production of silk, appearance of the moth, microscopy of the moths and of the eggs, packing of the silkworm seed. Laboratory for the preparation of the seeds, Administrative and Legislative measures in France and abroad.

There is also an oral examination, a practical microscope test, and a practical test on the preparation of the seed. (*Bulletin de l'Office de Renseignements agricoles*, No. 9, 1925).

918. **France: Schools of Agriculture.** — In the *Comptes Rendus* of the general meeting in 1925 of the *Société des Agriculteurs de France* information is inserted on the activities and present educational facilities of various educational institutions in respect of instruction in agriculture. These notices are part of as many short reports read to the Social Section of agricultural instruction and referring to the following schools: Angers, Flers de l'Orne, the secondary school of agriculture of the Union of Anjou, of Mairoy, Avron and Meslay, of la Félicité in Aix-en-Provence, Purpan, the Thénard school at Sens, the Morbihan schools, and those of Vauseblets (Guernsey), Lunéville and the Institution MICHEL PERRET at Limonest (Rhône).

Reports were also made on the agricultural instruction in the Landes, in Finistère and in the Pas de Calais and on the household management instruction. (*Bulletin de la Société des Agriculteurs de France*, Vol. LVI, *Session générale de* 1925).

919. **France: Agricultural Subjects for Prize Competition** set by the *Société des Agriculteurs de France*. — *Agriculture:* Chemical processes for weed killing. Comparative experiments and results: quantity of chemicals employed, proper time for the process, cost, etc. — *Horticulture*: The best forms or best varieties in a given district for intensive cultivation on a commercial scale for profit. — *Viticulture:* Liqueur wines considered in relation to the vineyard: their preparation and their effect on grading of wines. — *Animal husbandry:* Persistent diarrhoea of cattle (*enteritis paratubercolaris*) regarded as a special disease of certain regions, its frequency, severity, economic importance, safeguards or prophylaxis treatment.

In addition, the Section "Live Stock Economy" of the Society has announced the SCHNEIDER prize competition to be awarded to the best account of the Breeders' Unions for the improvement of stock, especially in the countries with breeds not yet established and in regions devastated by the war. This last competition closes on 31 December 1926, while for the four previously mentioned the date on which entries close is fixed for 31 December 1925. (*Bulletin de la Société des agriculteurs de France*, Year 57, No. 6, Paris, 1925).

920. **France: Agricultural Educational Journey in Alsace.** — The Institut National Agronomique of France has organized this year, with

the help of the Société commerciale des Potasses, an expedition into Alsace for 92 students of the second year. The objectives of the journey were the inspection of the sylvinite beds and of the works for the treatment of the raw mineral, a study of the vineyards in the neighbourhood of Colmar and the examination of the Alsatian forests on the plain and on the mountains. (*Journal d'Agriculture pratique*, Year 89, No. 27, Paris, 1925).

921. **Tunis: Agricultural Education.** — This is mainly given at the Ecole Coloniale d'Agriculture at Tunis and at the Smindja Farm School. The colonial school is attended by students who are already well advanced in their work, while the Smindja school receives boys from 14 to 18 years old, just leaving the primary school and anxious to learn modern methods of cultivation. The farm training of the boys whose general education is not up to the standard for admission to the Smindja school is carried on in the regional experimental gardens (Sfax, El Asib, Tabarka) and by means of courses for drivers of farm machinery, held at the Colonial School at Tunis.

The diffusion of agricultural information and of improved methods of cultivation is ensured by publications, practical demonstrations, seasonal courses. A monthly publication in Arabic, *La Mejellah*, of which 3000 copies are printed, and a farm calendar of the fellah, with 1500 copies are distributed free.

In 1924, 76 demonstration fields have been organized for native cultivators: 48 for illustrating the preparation of the soil and the use of superphosphates for the cultivation of cereals, and 28 relating to the use of chemical fertilisers for olives. In the districts of Kef, Thala, Maktar, Teboursouk, Medjez-el-Bab, Souk-el-Arba, Mateur, Soussa, Kairouan, Gafsa, Tozeur and in the military territories there have been held 35 demonstrations on pruning and grafting of olives, which were attended by 1960 persons. In Tunis and at Soliman two olive-pruning competitions took place and also courses and competitions in olive grafting.

As a means of encouragement, plants, plant, seeds or silkworm seed, fertilisers, money prizes, medals, and diplomas for irrigation works or horse breeding, etc., are being distributed to the native farmers. (Fixation des indigènes au sol. *Bulletin Mensuel de l'Office du Protectorat Français, Tunisie*. Year 18, No. 170).

922. **French West Africa: Ivory Coast. La Mé Experimental Station.** — In the first half of 1924, besides a certain amount of clearing work, plantations have been made of oil palms and intercalary crops, cocoa and coffee. For germination, boxes have been used in which the coconuts were placed on a hotbed in layers under leaves of "Celtis". The transplanting was done both on to the open ground and among bushes. Some tests were carried out on a native method consisting in warming the fruit to hasten germination. The soil recently broken up was protected against the action of the sun's rays and the invasion of weeds by sowing with runner beans and Angola peas.

Experiments have been made on the different methods of employing a wooden press for making wine and cider, and a yield much superior to that obtained by native methods has been the result. The Laboratory has been meanwhile completely equipped. (*Bulletin mensuel de l'Agence économique de l'Afrique occidentale française*, Year 6, No. 50, Paris, 1925).

923. **Dahomey : The Pobé Experimental Station.** — The special object of this station is investigation of oil palms, their cultivation and industrial utilization. The results of laboratory researches have been used in the selection of the palm nuts and for ascertaining the best conditions for the extraction of the oil. (*Bulletin mensuel de l'Agence économique de l'Afrique occidentale française*, Year 6, No. 50, Paris, 1925).

924. **Great Britain : A Section of Timber Technology at the Imperial Forestry Institute, Oxford.** — Professor C. C. FORSAITH, of New York, State College of Forestry, Syracusa University, has accepted an offer of the British Government, made through the Imperial Forestry Institute of the University of Oxford to organize a section of timber technology in that University.

925. **Scottish Experimental Stock Farm.** — In connection with the Rowett Institute, Aberdeen, an experimental stock farm is to be established, as a memorial to the famous breeder of Shorthorn cattle, WILLIAM DUTHIE of Collynie, whose nephew, M. Duthie WEBSTER, has given £ 10 000 to the Institute for this purpose. (*The Times*, London, 11 May 1925).

926. **Great Britain : Training of Agricultural Organizers and Lecturers.** — In conjunction with the Development Commission, the Departments of Agriculture for England and Wales and Scotland have instituted a new class of scholarships with the object of training those who desire eventually to take up posts as agricultural organizers under county councils or as lecturers, whether at agricultural departments of universities, agricultural colleges, or farm institutes. The scholarships are of two years' duration, the first year being spent on investigational work in Great Britain and the second year abroad. The scholarship allowance in the first year will normally be £200 : the allowance in the second year will include provision for extra cost of travel and other expenses abroad. (*Science*, Vol. LXI, No. 1575).

927. **Great Britain : Settlers' College.** — The Australian Farms Training College will be opened in Norfolk during September, for the training in practical farming of university and public school men, on the completion of which they will be sent out to Queensland under specially advantageous conditions, by arrangement with the Queensland Government. Each man must possess a capital of £500, and the Queensland Government will make a loan not exceeding £750 to every settler, and will reserve a large tract of land for settlement.

The course at the College will include : general farm instruction, principles of cultivation of crops likely to be grown in Queensland, dairy work, stock raising, fencing and carpentry, and the erection of a portable house in which students will live for a time and do their own cooking. Pig breeding will form the main subject of the course. The Principal of the new college will be Mr H. V. POTTS, formerly Principal of Hawkesbury Agricultural College, New South Wales. (*The Times*, London, June 15, 1925).

928. **Great Britain : Scientific Research Workers.** — The British Science Guild has held an enquiry into the question of the supply of trained scientific research workers, and summarises several of the questions that arose, as follows :—

(1) The annual supply of research workers before the war was very limited and inadequate to the needs of the Nation.

(2) In response to urgent appeals, and with assistance by the Government, the annual number of science students at the Universities of Great Britain has been doubled, while the number of research students has been quadrupled.

(3) The present facilities for training scientific research workers in Great Britain are, however, still less than those of Germany and America before the war.

(4) There is still considerable unemployment among research workers, and freshly trained men are finding difficulty in obtaining suitable posts.

(5) Apart from the work of the Department of Scientific and Industrial Research, little fundamental research is undertaken by commercial firms, and the work of the Department itself is limited by its comparatively meagre endowments. (*Chemical News*, Vol. 130, No. 3395, 1925).

929. **British Guiana: The Kartabo Laboratory of Tropical Biology.** — The Tropical Research Station of the New York Zoological Society, located at Kartabo, British Guiana, has come under the University of Pittsburgh for several years. During the summer of 1924 eight students worked at this jungle laboratory, under the direction of Dr. ALFRED EMERSON, of the department of zoology. This experiment proved so successful that further courses are planned. According to a communication made by Prof. EMERSON to the periodical, *Science*, during the summer of 1925, a group of fifteen students will study at the laboratory under the direction of Dr. S. H. WILLIAMS, professor of zoology at the University of Pittsburgh, who will also give a course in ecology. The expenses for each student will be approximately 700 dollars, including travelling and living expenses and incidentals from New York and return. Stops will be made at the West Indian islands of Grenada and Trinidad.

Visits may be made to the Station at any time of the year by scientists. For information application should be made to Professor H. D. FISH, Department of Zoology, University of Pittsburgh, Pennsylvania. (*Science*, Vol. LXI, No. 1576, 1925).

930. **India: The Technological Research Laboratory of the Indian Central Cotton Committee** was formally opened at Bombay by H. E. the Viceroy of India on December 3, 1924. When complete, there will be Spinning and Research Laboratories; the former has been completed and is equipped with a spinning plant and instruments for testing cotton yarn. The Research Laboratory will carry out chemical, physical and microscopical examinations of cottons sent for trial. By collating the results obtained in the two laboratories from a sample of raw cotton, it is hoped that it will be possible to make a fairly accurate statement as to the spinning qualities of a cotton and in this way assist plant breeders. (*The Agric. Jrnl. of India*, Vol. XX, Part II, Calcutta, 1925).

931. **Ceylon: New Chemical Laboratory at Peradeniya.** — The new Chemical Laboratory of the Department of Agriculture was opened by H. E. the Governor on March 12, 1925. The new laboratory has been established in order to meet the urgent need for further research in agricultural chemistry.

Accommodation will be provided for post-graduate students from the University of Colombo. (*Tropical Agriculturist*, LXIV, No. 4, Perademya, 1925).

932. **The Imperial College of Tropical Agriculture, Trinidad.** — An important meeting with reference to the above College took place at the Mansion House, London, January 29, when Lord Milner's appeal for £100,000 was presented by Lord Burnham and supported by Sir Arthur Shipley of Cambridge. The sum is required to complete and equip the new buildings and laboratories, and place the institution on a sound basis for research. The College is of international interest, as it is the only institution of the kind in the world ; its great aim is to increase knowledge and to apply such knowledge to the development of agriculture and to the increase of crop production. (*Tropical Life*, Vol. XXI, No. 2, London, 1925).

933. **Palestine : The Hebrew University of Jerusalem.** — The formal opening of the new University of Jerusalem by Lord BALFOUR took place on 1 April last. At that date the laboratories for chemistry (including general chemistry, analytical chemistry, biological chemistry, and chemistry of colloids) and bacteriology were already organised, and those for physiology, physics and mathematics were in process of organisation. (*Chemistry and Industry*, Year 44, No. 14. London, 1925).

934. **Hungary : Higher Forestry Instruction.** — In consequence of the occupation by Czecho-Slovakia of Upper Hungary, the teaching staff of the old-established higher school of mining and forestry at Cheminitz has been moved to Sopron (Cedenburg). The foundation of this school dates from 1770, and it has given a number of distinguished names to Hungarian sylviculture, including HEINRICH DAVID WILCKENS (1832), RUDOLF FEISTMANTEL (1871), FRIEDRICH SCHWARTZ (1866), KARL WAGNER, JACOB LAZÁR, JULIUS SOLTZ and LUDWIG FEKET. The new school which is established at Sopron took the name of the Royal Hungarian Higher School for Mining and Forestry Engineers (*Kön. Ung. Hochschule für Bergingenieure und Forstingenieure*), and retained the former division into four faculties : forestry, mining, the working of steel, metallurgy, all of which grant the diploma of engineer.

The system was antiquated and was not compatible with the scheme of conferring the diploma of forestry engineer alone after four years of study in the higher school and two years practice. Hence it has been abandoned and replaced by the so-called *rigorosum* system, which includes two examinations, one at the end of the fourth and the other at the end of the eighth half year. The subjects to be offered in the first are : mathematics, botany, geodesy, forest classification ; in the second : sylviculture, forest production, forest organisation.

The faculty of sylviculture includes the following chairs, with the necessary buildings and collections of objects in addition : botany, including general and special botany, and phylogenetics ; chemistry and forest soil science, including organic and inorganic chemistry, forest classification ; forest zoology and protection of forests ; geodesy and systematisation of mountain water courses, forest railways, roads and water supply, forest organisation, including measuring of timber and forest estimates ; utilisation of forest products, including timber dealing ; sylviculture, game and fishing regulations ; forestry policy, including national economy and the administration of forests ; forest techno-

logy, including the construction of the machines and the mechanical technology of timber; physiology and pathology of forest species. Instruction will also be given in forest law and legislation relating to forests, while for the other subjects: mathematics, descriptive geometry, geology, electrotechnics, civil law, commercial law, administrative law, etc., instruction is given by a staff common to the other faculties.

Practical expeditions are made into the rich forests of Sopron which extend over 9000 *Kat-Joch* (cadastral yokes: one *Kat-Joch* equals about half a hectare, i. e. about an acre), on the slopes of the Austrian Alps. Of this forest area, 3200 *Kat-Joch*, in Agendorf near the Austrian border, are administered by a Royal Hungarian Office, as a demonstration forest park, attached to the Higher School of Sopron. (*Centr. f. D. Forstwesen*, Year 50, Parts 7 to 12, Vienna and Leipzig, 1925).

935. **Italy: The Bari Agricultural Experiment Station.** — This station was inaugurated on 12 April 1923 and is under the direction of Prof. ENRICO PANTANELLI. Among its principal functions is the study of the soils and the climate of Southern Italy, with a view to the selection of the varieties of grain and forage plants, taking as criterion resistance to drought. As will be seen from the address on the occasion of the inauguration of this new institution, by His Excellency, DE CAPITANI D'ARZAGO, Minister of Agriculture, the programme is designed with a view to the increase of the production of grain and forage plants and has already been drawn up by CELSO ULPIANI and the watchword "American dry-farming" put in the forefront of the work of the Station. Among its other responsibilities will be that of encouraging arboriculture, and of investigating the possibility of drawing on, for agricultural purposes, the waters that lie unused in the subsoil in great stretches of Southern Italy.

From a report on the activity of the Station in 1922-23, the valuable work already accomplished by the Station in the two years 1922-23 is evident. Investigations and work on soils were made of the soils of Apulia, investigations of underground water, experiments in irrigation, fertilising and cultivation; meteorological observations taken; cultivation and selection of spring cereals, cultivation of summer cereal crops, pulse crops, forage plants, industrial aromatic and medicinal plants, and vegetables for profit, enquiries on the cultivation of olives, the almond, ornamental plants and exotic plants for profit.

The report quoted is full of information of all kinds, and is illustrated by a number of plates, presenting a thoroughly practical survey of the field of experiment that may be worked on behalf of the agriculture of Southern Italy (*Stazione agraria sperimentale di Bari*. Report on the activity of the Station in the two years 1922-23: pp. VII + 145 small octavo, 16 tables, Bari, 1924).

936. **Italy: Development of the Agricultural Cinematograph.** — This is now in course of full development in Italy and is making itself felt as a method of the first rank for the diffusion of progressive ideas in the country districts. Although not at the outset supported financially and otherwise as generously as it might, and should have been, by the competent State authorities, the agricultural cinematograph, owing to the efforts and the assistance of various agencies, societies, private individuals and different administrative

bodies, has succeeded in proving its importance, so that it is now regarded as an indispensable adjunct to instruction.

Propaganda by means of the cinematograph is organized by the " National Institute Cerere ". Among the most important films are to be noted those on scientific fertilising, on cultivation of cereals, viticulture and fruit growing, industrial plants, control of plant diseases. Beginning with 160 films in 1920, the number was raised to 1200 in 1922 and to 2000 in 1924, while in the current year provision is being made for a larger number.

Films on vegetable growing, on olive and citrus fruit cultivation, and stock rearing and preservation of forage are being prepared.

937. **Paraguay: School of Agriculture at Asuncion.** — Authority has recently been given for the establishment of an agricultural school in the Botanical Garden of Asunción under the direction of the botanical staff. The amount of 600,000 pesos national currency is appropriated for the equipment of the school. The sales of the school's products will help to defray expenses. (*Bulletin of the Pan-American Union,* January 1925).

938. **Czecho-Slovakia: Jubilee of the School of Agriculture of Tetschen-Liebwerd.** — On 6 May last a celebration took place at Liebwerd on the occasion of the 75th anniversary of the foundation of the Agricultural Section (*Landwirtschaftliche Abteilung*) of the German Higher Technical School (*Deutsche Hochschule*) at Prague. After the official speeches on the occasion, the Dean of the Section, Prof. WIRTH, delivered an address which was highly applauded, in the course of which he gave an account of the development of the natural sciences, and of agriculture at the school and also of the future prospects of the Liebwerd School. (*Landwirtschaftliche Fachpresse für die Tschechoslovakei,* Year 3, No. 17, Tetschen).

939. **Czecho-Slovakia: Agricultural Museums.** — On 4 March 1924, the Minister of Agriculture, Dr. RODZA, set aside 15 million crowns for an agricultural museum at Prague and a similar institution at Bratislavia. In addition, the Ministry of Agriculture has now bought the land on which to place the building for the Prague Museum, while for that at Bratislavia the ground has been purchased by a Committee appointed for the purpose. Special Museums of agricultural interest already exist in Czecho-Slovakia, for example there is one at Brunn, attached to the Higher School of Agriculture, and one at Frydek (Silesia). (*Publication du Ministère de l'Agriculture de la République Tchécoslovaque,* Prague, 1 May 1925).

940. **Czecho-Slovakia: Course of Instruction for Milk Testers, at Znaim.** — The German Section of the Moravian Council of Instruction in the provincial school of agriculture and oenology at Znaim organized a practical technical course, from 15 April to 16 May 1925, for assistant testers of milk. The number of those taking part in the course was limited to 12 and only sons of farmers were admitted. Admission was limited to students over 18 years of age, of good physical constitution, who had already satisfactorily passed through a lower agricultural school. Each of them received 500 crowns to cover expenses, and were on the other hand under an engagement to take positions as assistant testers on finishing the course. If this undertaking was not observed, the subsidy received had to be returned, and in the case of students under age, the father or the guardian were legally liable for the repay-

ment. Six students could be lodged and boarded on the premises of the school for the sum of 310 crowns each. (*Landwirtschaftliche Fachpresse für die Tschechoslowakei*) Year 3., No. 10. Teschen, 1925).

Agricultural and Scientific Associations and Institutions.

941. **The Singapore Office of Epidemiology.** — A Conference was held at Singapore from 4 to 15 February 1925 on the occasion of the inauguration of the Far-East Epidemiological Information Bureau. Representatives attended of the health offices of Ceylon, China, British Borneo, the Straits Settlements, the Federated Malay States, British India, French Indo-China, Dutch India, Hong-Kong, Japan and the Philippine Islands. In addition Dr. NORMAN WHITE, member of the Commission on Epidemics, attended as delegate of the League of Nations.

The subject of the Conference was the establishment of the rules for the working of the Singapore Office of Epidemiology. The maintenance of the Office is for the time being ensured by the Rockefeller Foundation which has placed at the disposal of the Health Organization of the League of Nations 125,000 dollars to be assigned over a period of five years. The Rockefeller Foundation attaches a condition that the annual expenditure is not to exceed 50,000 dollars. It is hoped that the Governments concerned will take the necessary measures for ensuring the funds for maintaining the Singapore Office, if after the five years its work has proved of value. Dr. GILBERT BROOKE, of the Straits Settlement Medical Service, has been placed in charge of the Office. (*Résumé mensuel des travaux de la Société des Nations*, Vol. V No. 4: 1925).

942. **The Belgian Peasants' Union** (*Boerenbond*). — On 1 June last the General Assembly of the Belgian *Boerenbond* was held at Louvain, attended by 2000 delegates of the respective agricultural syndicates. From the report for 1924 made by the General Secretary, Canon LUYTGAERENS, it appears that at the end of the year in question the number of the guild had risen to 1133 including in all 98,706 members, representing as many families.

The work of the *Boerenbond* is carried on by the Secretariate in collaboration with the subordinate services: documentation, inspection, League of Farm-women's Clubs, General Federation of Horticulturists. The intention of the Union is to promote both the general education, and the technical knowledge of the members, as well as their social sense and feeling for co-operation. Every year the *Boerenbond* organizes a series of "days of study" attended by about 800 representatives as a rule: it publishes two weekly journals and monthly reviews. In 1924 it published also eight treatises and technical manuals and arranged for the holding of 3440 lectures to agricultural syndicates.

The *Boerenbond* carried on systematic action with a view to promoting vocational agricultural education and for that purpose has established in nine centres, courses of training for women teachers to give instruction in the elementary stages of rural household management, which courses were followed by 187 students. It took part also in the setting up of 22 district agricultural schools, intended for pupils who have already satisfactorily passed through the courses of elementary stages, or sections. On the other hand 263 of these elementary sections, established by the initiative or with the co-operation

of the guilds, have entered successfully on their third year of existence. In 1924 the League undertook a campaign for the development of rural libraries and for the foundation of a technical agricultural library in connection with every syndicate.

The League of Farmwomen's Clubs, which included at the end of 1924 336 affiliated clubs with a total of 56224 members, has organized 117 courses, each of 3 to 4 days, on various subjects of interest, in particular household science, in addition to a series of 4 "days of study" at Louvain, attended by 241 local organising members, and 8 provincial "days" for rural housewives, attended on each occasion by thousands of peasant women; 1884 lectures were also given. The General Federation of Horticulturists arranged 178 lectures, held 17 local "days of study" for potato growing, undertook an educational journey in Holland and Poland, and organised several regional horticultural exhibitions. Competitions in cultivation were organised on a larger scale, and in the province of Antwerp alone 213 plots for rye and 274 for potatoes were planned for this purpose. The technical services: buildings, drainage, electricity, displayed great activity, and 1485 analyses were made by the laboratory.

At the end of 1924, there were 112 local agricultural syndicates affiliated to the "General Federation of the Stock-breeding Syndicates". The department for small live stock breeding was in touch with 24 poultry keeping unions. The *Boerenbond* also continued to carry on valuable work in connection with tariffs taxation, mutual insurance, the housing crisis, war losses and also more directly by the joint purchase and sale of eggs and butter, and the *Comptoir d'achat et de vente*, among its other activities, purchased for its members in 1924 196,528 tons of fertiliser, feeding stuffs and other agricultural requisites. The value of these goods, together with that of the supplies of farm machinery and dairy equipment amounted to more than 108 million francs.

There should also be mentioned the work, by no means unimportant, done in connection with agricultural credit, insurances and land improvement, subjects outside the scope of this Review (Report, communicated to the International Institute of Agriculture by the *Belgische Boerenbond*, 24 Minderbroedersraat, Louvain, Belgium).

943. **Brazil: The Government Seeds Service and the Cotton Service.** Seeds. — In 1923 there were incorporated with the Department of Agricultural Inspection and Development (*Serviço de Inspeçcão e Fomento agricolas*) the seed farms of the former Sowings Service (*Serviço de Sementeiras*), and, by the Decree No. 16663 of 5 November 1924, also the Deodoro Pomological Station (*Estação de Pomicoltura*) and its independent sections. Of the seed farms now in existence Rezende (in the Rio Janeiro district), Lorena, Soã Simão (State of Sao Paulo), Itajahy (State of Santa Catharina) and Rio Branco (State of Minas), the three first are in full working order, particularly the farm of São Simão, which is yielding excellent results. In that of Lorena, which is passing through its initial stage, an area of 75 hectares is being prepared which will very shortly offer the best conditions for rice growing by irrigation. On the Rezende farm 45 hectares were brought under cultivation and good progress has been made with the laying out of nursery plots. The Itajahy farm needs a larger area to attain real success, and the Rio Branco farm is in process of organisation.

In 1924 distributions were made by the Ministry of 32,674,1494 kg. of seeds of the following species : lucerne, 9,881,000 kg. ; rice, 12,477,000 ; "capim jaragua", 36,749,000 ; "capim gordura roxo", 58,664,000 ; sweet potato, 51,003,000 ; beans, 983,000 ; millet, 47,157,000 ; wheat, 63,738,546 ; vegetables, 1,307,145 ; "mucuna", 34,739,000 ; miscellaneous seeds, 3,583,000 kg. ; 29,891 grafts were also distributed. The plants distributed from the Pomological Station amounted to 31,813, of which 7771 were grafted.

Cotton Service (Serviço do Algodão). This service was organised by the Decree No. 16 122 of 12 August 1923 and continues to produce excellent results. The total production of cotton in 1924-25 is reckoned at 131,118 metric tons and taking into account that the consumption of raw material by the Brazilian spinning and textile factories, from 1920 to 1923, has increased by about 10,000 metric tons, it is clear that the cultivation of cotton in Brazil is steadily being extended. Agreements have been concluded with the States of Parà, Bahia, Minas Geraes di Parahyba, Rio de Janeiro, Sergipe Maranhao, Pernambuco, Rio Grande do Norte, Ceara and Alagoas, for the carrying on of the cotton-growing services and in the last six States the work is done by the respective governments under the technical direction of the Ministry of Agriculture. In the States of Parà, Bahia, Minas Geraes, Parahyba and Rio de Janeiro, the services in question are actively carried on and there are six "fazendas" for seed, with plantations in full working order. Progress is being made as regards Experiment Stations and seed "fazendas" in Sergipe, Ceara and Pernambuco, and in Alagoas, although the agreement is of much more recent date, considerable interest in cotton cultivation is already observable.

Mention may also be made of the Union of Experiment Stations of Piricicaba and Serido and of the Fazenda de Sementes of Coroatà, the object of which is the systematic selection of the improved varieties.

The Government Cotton Service has distributed 175,500 kg. of seed of the varieties best adapted for the different parts of the country. In accordance with the resolutions passed by the International Cotton Conference of 1922, the Government proposes to establish cotton exchanges in Rio de Janeiro and in other Brazilian markets.

Cleaning and Disinfection of Seed. — In 1924 there was a noticeable falling off in the activity of the service for cleaning and disinfection of seed, as compared with 1923, when 80,760 sacks of seed were cleaned, etc. In the following year 20,761 empty sacks were disinfected, which had previously been used for coffee. In conjunction with the Superintendence of Cotton Department a disinfecting machine was installed to effect disinfection of cotton seed and bales, by means of hydrocyanic acid gas. (*Mensagem apresentada ao Congresso Nacional na abertura da segunda sessao da decima segunda legislatura pelo Presidente da Republica* ARTHUR DA SILVA BERNARDES : 1925, *Diario Official*, May 1925).

944. **Brazil : A Permanent Government Agricultural Information Service.** — From a communication made by M. DEOCLECIO DE CAMPOS, delegate of the Brazilian Government at the International Institute of Agriculture, the following information is taken as to a new Service which the Brazilian Government has established, with the object of obtaining information every

month on the agricultural situation in every commune of Brazil as regards the principal crops.

The Service, which is defined as an agricultural statistical service endeavours to collect each month, for a series of crops, the facts relating to sown areas, crop conditions (100 = very good ; 80 = good ; 60 = average ; 40 = poor ; 20 = very poor ; 0 = means destruction of the crop) ; prospects of yield (normal, increase, reduction), preliminary harvest forecast and actual yield. Reports are made on the following crops ; pineapples, lucerne, cotton, rice, oats, bananas, potatoes, rye, barley, beans, maté, maize, wheat, tobacco, oranges. Data are also received as regards the forecasts, the preliminary estimates and the actual yield of sugar (first, second and third class), molasses, brandy, alcohol, flour, cassava and wine.

The information is collected in every Commune of the Federation of Brazil by means of monthly enquiry forms, both by farmers and individual volunteers, and by the officials of the service of Inspeçao e Fomento Agricola e Industria Pastoril, and of other public bodies set up for the purpose. As a basis of comparison, the correspondents receive the data of the previous year, relating to their Commune. The enquiry forms are returned, not later than the tenth of the month succeeding the month to which they refer, to the Federal Agricultural Inspectorate to which the Commune belongs or directly to the Head Office of the Serviço de Inspeçao e Fomento Agricolas at Rio Janeiro. (L'organisation récente de la statistique agricole au Brésil. Communication made by M. DEOCLECIO DE CAMPOS, delegate of Brazil to the International Institute of Agriculture, 1925).

945. **France : "Colonie-Sciences " Association.**—Under this name there has been founded in Paris (12, Avenue du Maine), under the presidency of General Messimey, an association the object of which is to bring together, for work in common, the colonial agricultural experts, the colonial laboratories, institutes and similar organisations. The intention is to specify in detail the scientific methods of cultivation in the colonies, to set up a service of documentation and of centralisation of information on the various branches of colonial agriculture, to make enquiries into and to carry into effect the schemes best calculated to increase the number of agricultural experts and colonial technicians, and to promote the establishment of new Experiment Stations in the colonies and to make fuller use of those already existing. The Proceedings and the Reports, as also the scientific publications of the " Colonie-Sciences ", will be published in the *Revue de Botanique appliquée et d'Agriculture coloniale*. (*La Nature*, No. 2672, Paris, 1925).

946. **Great Britain : Apple Packing Stations.** — In an article in the *Journal of Pomology and Horticultural Science*, H. V. TAYLOR states that some progress has been made in the use of grading and packing systems for home grown apples in England, and refers also by way of explanation to what is done in this respect in Canada and the United States.The British Fruit Packing Co. Ltd. has lately established near Yalding Railway Station, Kent, an apple packing station, equipped with the most modern machinery. This station is managed by Mr. GREGSON, who has had experience of the working of an apple packing station belonging to the Associated Growers of British Columbia. The Kent Station is favourably situated in the midst of a very large fruit area, and can

handle daily a large quantity of fruit. Besides grading and packing the apples, the Company undertakes the transport of the fruit by road to the London markets.

A second station on the same lines has been established at Cottenham near Cambridge, as a result of the action of the "West Cambridge Fruit Growers Association" and of State assistance. Both the Stations will adhere to the same standards for grade. (H. V. TAYLOR, M.B.E., A.R.C.S., B. Sc., Apple Packing Stations, Progress in England. *The Journal of Pomology and Horticultural Science*, Vol. IV, No. 7. London, 1925).

947. **Canada: The Dominion Water Power and Reclamation Service.** — This Department of the Canadian Ministry of the Interior has published a report on its activity including production of hydraulic power, irrigation, drainage, etc., in the financial year ending 31 March 1924. In the previous years, the two Services, that of the water power and the reclamation department, were distinct and hence their respective reports were published separately. This year a single report has been issued on both departments as they have been combined. (*Canadian Water Power and Reclamation Report*, 135 pp., 25 plates, Ottawa, 1925).

948. **Italy: The "Parco Nazionale d'Abruzzo".** — By a decree of July 12, 1923, the Parco Nazionale d'Abruzzo was given independent status. This action had already been contemplated in a preceding decree of January of the same year. In this way one of the most picturesque areas of the world was placed under the protection of the law. The Hon. ERMINIO SIPARI, President of the "Consorzio per la Condotta Forestale Marsicana" and of the "Commissione amministratrice dell'Ente autonomo del Parco", has arranged for the publication of a manual containing the legal enactments and general information relating to the district. As early as 1923, the Hon. SIPARI informs us in his preface to the little book, the need for the prompt publication of a first edition was felt, in order to bring to the attention of those Communes whose territory comes partly within the Park, the relevant legislative enactments. The manual is fairly exhaustive, though it must not be considered as a final edition, since it will be added to by degrees as the regulations and the general provisions in regard to the Park are improved.

SIPARI, with the consent of the respective authors, has added to this new edition special articles which have been published already in another form, Besides an article by SIPARI himself, which summarized briefly the proceedings which led to the issuing of the decree concerning the Park, the manual contains a description of the Park from Gioia to Porcadacero, already published in *Saggi di Itinerari turistici per l'Abruzzo e Molise* by L. BOLOGNA, the description of a trip from *Villavallelonga a Bisegna attraverso il Parco* by A. ROSSI, and an article by E. MARCHETTI on *La Valle dell'Alto Sangro*. Finally, in order to render the manual of still greater practical value, two chapters were included, one on information concerning the destruction of noxious animals, and *information on vipers*, edited by Dr. CARLO PAOLUCCI, Director of the Park. (*Manuale del Parco Nazionale d'Abruzzo*, 2nd edition, 100 pp. 12°, carta geografica, Roma, 1925).

949. **Czecho-Slovakia: Horse-Breeding in Czecho-Slovakia.** — According to the *Narod Listy* the State, civil and military horse-breeding sta-

tions in Czecho-Slovakia have been given up for reasons of economy, following on proposals made by the Breeders' Unions interested. The Government stations will be replaced by others belonging to district Consortiums for horse-breeding. It has been shown that a horse costs 35,000 crowns to rear up to the age of 4 years in the State stations, whilst the market price of a horse of the same age is barely 7,000 crowns. (*Landwirtschaftliche Fachpresse*, Year 3, No. 17, Tetschen, 1925).

Congresses and Conferences.

950. **France: International Dairy Conference. Paris, May 1925.** — The Permanent Bureau of the "Fédération Internationale de Laiterie" met on May 9, 1925 at Brussels, under the presidency of the deputy the Hon. J. MAENCHANT. Delegates from the National Committees of France, England, Holland, Denmark, Switzerland and Belgium were also present. The delegates of Sweden, Norway, Ireland and the Grand Duchy of Luxemburg regretted their inability to attend.

The Permanent Commission fixed the order of the future Congresses to be held in Europe as follows: in France, 1926; in England, 1928; in Belgium, 1930; in Denmark, 1932; and in Italy, 1934.

The Congress of 1926 will take place in Paris in the first fortnight of May. The question of milk will be discussed very fully, that of the designation of cheeses in international trade, and the question of the formation of an "International Dairy Bureau" at Brussels.

951. **Canada: World's Poultry Congress 1927.** — This Congress will be held in Canada in 1927 on the invitation of the Dominion Government. An influential Committee has been formed representing all the provinces of Canada, with members also from the United States. The honorary Chairman is the Dominion Minister of Agriculture, and the Acting Chairman is Dr. GRISDALE, Deputy Minister of Agriculture. At a meeting of this Committee held in Toronto on 11 September, it was decided that the Congress and Exhibition shall be held at Ottawa, commencing 27 July 1927. The fine buildings of the Canadian Exibition at Ottawa have been placed at the disposal of the Committee. Mr. EDWARD BROWN F. L. S., President of the *International Association of Poultry Instructors and Investigators*, has accepted the position as President of the Congress and Exhibition. Official invitations will in due course be sent to all Governments to participate in the Congress and Exhibition, and plans are being formulated for securing the co-operation of those engaged in investigations and research as well as producers and distributors.

952. **Belgium: Second International Conference for the unification of the formula for heroic remedies. Brussels, September 21, 1925.** — Following on the First Conference held in 1902 also at Brussels.

953. **I. International Congress of the Technical Press. Paris, September, 1925.** — Under the auspices of the Syndicate of the technico-industrial, commercial and agricultural Press of France. The aim of the Congress was to examine all the relevant questions, both from the technical and financial points of view, and to study the best means of increasing the circulation of the technical press throughout the world.

954. **Rumania: International Congress of Pure and Applied Chemistry. Bucharest, last week of June, 1925.**

955. **Poland: First International Conference of Sugarbeet Growers. Warsaw, 20 June, 1925.** — This conference was called by the General Polish Confereration of Sugarbeet Growers, with the object of presenting to the 12th International Congress of Agriculture a programme for the protection of the growing of sugarbeet in Europe against the competition of cane sugar.

956. **France: International Silk Congress. Paris, 12-13 June, 1925.** — Promoted by the Silk Federation. Points discussed: unification of the customs tariff for the silk industry; uniform designation of artificial silk; improvement of natural and artificial silk; procedure for the examination and control of the quality, weight and condition of the various silk textures.

957. **Proceedings of the Second World Poultry Congress.** — This has been translated into French and contains the 87 reports presented to this Congress, held at Barcelona, 10-18 March 1924. It forms a volume of octavo 430 pp., illustrated by numerous plates.

958. **Germany: General Assembly of the German Chemical Societies of Food Industries.** — (Vereine Deutscher Nahrungsmittelchemiker) Munster Westfalia, March 21-22, 1925).

959. **Belgium: Maritime and Colonial Congress. Ostend, 24-28 August, 1925.**

960. **Brazil: Oil Congress. San Paolo, Brazil.** (date not yet fixed).

961. **Canada: Fox Congress, Montreal, 26-28 June, 1925.** — Promoted by the American Fox Institute. For information apply to Mr. H. A. ADAMS (Secretary), Investment Building, Washington, D. C., United States.

962. **French National Week for the Export of Agricultural Products.** — The date of this "*Semaine nationale de l'exportation des produits agricoles*" is still not fixed at the time of publication of the present number. It will comprise four sections: I. Foreign markets; II. Exportable products; III. North Africa; IV. Ways and means for the assistance of agricultural export. The subject of the agenda of Sections II and IV have been published.

Section II: (1) Breeding, draught animals, butchers' beasts; slaughtered beasts, meat and by-products; — (2) Dairy products; — (3) Poultry etc.; — (4) Seeds; — (5) Cut flowers; — (6) Tree and flower nurseries; — (7) Fruit (fresh, dried or desiccated); horticulture by irrigation, early vegetables, dried vegetables; — (8) Cider industry; — (9) Table grapes; — (10) Effects of export on French vineyards; — (11) Good quality wine and liqueurs; — (12) Brandy; — (13) Fodder cereals and straw; — (14) Flour and bran; — (15) Maccaroni, etc; — (16) Beetroot, sugar, syrups, sweets, preserves; — (17) Potatoes; — (18) Agriculture, honey, wax; — (19) Hops; — (20) Textile plants; — (21) Silk growing; — (22) Essential oils; — (23) Preserving industry; — (24) Plants used as drugs, medicines, or perfumes; — (25) Perfume distillery; — (26) Timber, forest products, tannin bark, cork.

Section IV: — (1) Agricultural export societies; — (2) Commercial organisations available for exporters; — (3) Standardisation of exportable products; — (4) Measures against unfair competition and the protection of

designations of origin ; — (5) Sanitary and veterinary guarantees with respect to the export of animals ; — (7) Credit in matters of export ; — (8) Function of railways in agricultural exports ; improved utilisation of land transport ; — (9) Export tariffs and combined tariffs ; — (10) Use of ice in transport and warehouses ; — (11) Function of the French flag in the export of agricultural products ; — (12) Commercial agreements ; — (13) General policy on agricultural export.

For particulars : *Secrétariat de la Semaine Nationale de l'Exportation des produits agricoles*, 23, Avenue de Messine, Paris (VIII).

963. **France : Ninth National Congress of Fishery and Sea Industries. Bordeaux and Arcachon, September 1925.** — Seven sections: (1) Scientific enquiries (chairman, JOUBIN, member of the Institute) ; (2) Technique of sea-fishing (chairman, LECOURBE, director of the Pêches maritimes) ; (3) Sea industries (chairman, LAUBOEUF, naval engineer) ; (4) Trade and Sale of products (chairman, LE BAIL, deputy of Finistère) ; (5) Social economy and legislation (chairman, GIRAUD, director at the Undersecretariate of the mercantile marine) ; (6) Colonial fisheries (chairman, GRUVEL, professor at the Musée d'Histoire naturelle) ; (7) Oyster beds (chairman, PRUNIER).

964. **France : Congress of Table Grapes, Agen, August 1925.** — Organised by the Compagnie d'Orléans in collaboration with the agricultural services of the Compagnie P.L.M. et Midi and with the support of the Office départemental agricole du Lot-et-Garonne.

965. **France : Fifth Annual Reunion of the "Comptoir Français de l'Azote". Paris June 1925.** — Lectures : Ing. Agr. TRUFFAUT, The micro-organismes of the nitrogen cycle. — Professor BRETIGNIÈRE (École nationale d'Agriculture de Grignon), Nitrogenous fertilisers ; — Prof. SORESI (director of the Milan travelling lectureships on agriculture), Work of the travelling lectureships on agriculture in Italy. — CARROLL (head of the Propaganda Service of the British Sulphate of Ammonia Federation), Result of experiments with ammonium sulphate at Rothamsted and Intensive nitrogenous fertilisation of meadows and pastures. — KONING (manager of the *Comptoir Belge du Sulphate d'Ammoniaque*), Contribution to the study of the application of ammonium sulphate and Lime treatment and nitrification Dr. BUEB (manager of the Berlin *Stickstoffs Syndikat*), Policy for the popularisation of nitrogenous fertilisers.

Photographic projections and cinematographic films will illustrate the different lectures.

According to a communication made to the same assembly, the consumption in France of nitrogenous mineral fertilisers has risen from 71,000 metric tons of nitrogen in 1915 to 96,000 tons in 1924, an increase due chiefly to the consumption of cyanamide and of ammonium sulphate.

966. **France : Seventh French Agricultural Congress. Rouen, 13-15 May, 1925.**

967. **France : Wood Charcoal Congress. Blois, 26 April, 1925.** — Among the numerous solutions proposed for the production of a national carburant, is that of the direct utilisation of wood and wood charcoal. It is estimated that, under regular and normal working the total yield in charcoal of the French forests may amount to 15 million quintals, i. e. double the quantity

required to replace the imported charcoal. In addition much of the waste from wood cutting would at the same time be turned to advantage. The above Congress has been organized, with a view to popularising the employment of this carburant, by the Compagnie d'Orléans in co-operation with the Comité de la Forêt du Loir-et-Cher. (*La vie agricole et rural,* Year 14, Vol. XXVI, No. 18, 1925).

968. **Great Britain : The Imperial Entomological Conference, London, 9 to 18 June, 1925.** — About twenty representatives of overseas Governments attended this Conference, which was called by the Secretary of State for the Colonies, at the request of the Imperial Bureau of Mycology. Among the papers read the following may be mentioned : Dr. G.A.R. MARSHALL : The objects and the organisation of agricultural entomology ; — Dr. T. W. MUNRO : Organisation of Forest Entomology ; — G. B. WILLIAMS : Entomological Organisation in Egypt ; — T. J. ANDERSON : Insect Pests in Kenya ; — H. H. KING : The instruction and training of the agricultural entomologist. (*The Times*, London, 15 June 1925).

969. **Ninth Congress of Italian Olive-Growers, Bari, 19-21 October 1925.**— This Congress was arranged by the *Società nazionale degli Olivicoltori* and was called to consider fundamental problems connected with the improvement of olive growing and oil making. There was a large attendance of experts, olive-growers, oil manufacturers and dealers, who met at Bari from every part of Italy. In accordance with the wishes of the President of the International Institute of Agriculture, Prof. G. TRINCHIERI, Chief of Section in the Bureau of Agricultural Science, attended the Congress in the capacity of observer and expert.

At the inaugural meeting, Signor G. GRASSI, President of the National Society of Olive-Growers, in the course of the address of welcome, recalled, with the unanimous approval of the members of the Congress, the resolution arising out of his own proposal and passed by the Seventh International Olive-Growing Congress, Seville, December 1924, viz. that the International Institute of Agriculture should concentrate international enquiries on the Mediterranean varieties of the olive.

The principal subjects treated were : Old and New problems of olive-growing and oil-making ; practical measures for their solution. — The temporary importation of olive oil. — The growing of the olive from seed. — Observations on the susceptibility of the Bari olives to the fly' (*Dacus oleae*). — Control of the olive fly in the season 1925. — Freights in the oil trade, transport in general, empty barrels, packing material, the export trade. — Wider use of table olives. — The protection of olive plantations. — Pruning and fertilising of olive-trees. — New processes of extraction of oil from the husks. — New data on the biology of the *Phloeothrips oleae*.

On the conclusion of the Congress, an interesting excursion was made to the agricultural colony of Andria.

The tenth National Olive-Growers Congress will be held in Sardinia.

For particulars apply to the " Società nazionale degli Olivicoltori ", Via della Panetteria 27, Rome.

970. **Italy. Fifth National Forestry Congress and National Forestry Exhibition, Campobasso, 10-12 September 1925.** — As " obser-

ver " at this Congress, the International Institute of Agriculture appointed Dr. G. BORGHESANI and in this way a new phase in the activities of the Institute has been entered on, with a policy of taking part regularly in the work of the most important congresses, whether national of international, which deal with agriculture.

After the inaugural speeches, the Congress, opened with the report of Prof. A. SERPIERI on the main lines of the new forestry legislation in Italy (*Direttive della nuova legislazione forestale in Italia*) and in this connection the Congress after considerable discussion fully approved the principles of the Royal Decree 30 December 1923, on the reorganization and reform of the legislation in regard to woods and mountain lands. Prof. G. JOSA dealt with the conditions for a wide and effective scheme of Forest Policy (*Condizioni per una più vasta ed efficace politica forestale*) and in the discussion which followed Prof. CORTESI advocated the exploitation of certain mountain products and proposed a statistical enquiry on the profits to be obtained by the mountain populations by growing aromatic and medicinal plants. Prof. A. POVARI read a paper on the technique of reafforestation according to the most modern views and experiments; Comm. M. DE RENDIS reported on the question of Woods and Civic Rights of Enjoyment (*Boschi ed Usi Civici*) in regard to the application of the Royal Decree Law of 23 May 1924 on the reorganisation of these civic rights of enjoyment; Prof. A. TROTTER on the Improvement of the Pasture Lands of the Southern Apennines; Prof. G. DI TOLLA on Mountain Improvement Works and Regulation of Torrents; Prof. L. PICCOLI on Modern Technical Forestry Principles.

It was decided to hold the next Congress at Florence.

The First National Forestry Exhibition which was arranged on this occasion was divided into seven sections: Sylviculture and Forestry Instruction — Forest Industry — Mountain Pastures — Special Exhibits — Improvement of Mountain Land — Agricultural Show of the Southern Apennine — Hunting and Fishing.

For particulars regarding the Exhibition: Cattedra di Agricoltura of the Province of Campobasso (Palazzo Provinciale).

971. **Italy: National Land Improvement Congress. Naples, 3 to 5 September.** — Representatives of the Ministries concerned, attended the different Consortia, Institutes, public bodies, various associations and firms interested in the subject of land improvements. The International Institute of Agriculture, on the initiative of the President and as is being done in the case of other important conferences of the kind, sent in the capacity of observer, M. E. Morales Fraile, Ing. Agr., of the Bureau of Agricultural Science. The Congress was held on the occasion of the Land Improvements Exhibition (16 August to 10 September), among the exhibitors in which were the Ministries of Public Works, of the Colonies, National Economy, and the Interior, as well as 56 *Consorzi di bonifica*, 15 private land improvement associations, 15 various bodies, two banking institutions and four manufacturing firms. The exhibits included graphic representations, relief photographs and models of hydraulic apparatus, of material for controlling malaria, etc. in other words everything necessary to give a clear idea of the active work done in land improvement in the different parts of Italy and in accordance with the various-

systems. It is suggested, if the Exhibition proves a success, to make it permanent, and to bring it in the meantime to Rome.

Two lectures were given in advance of the Congress : Ing. M. MAGLIETTAI : Hydraulic technique in the land improvements of the South as compared with that of the North of Italy ; Comm. C. VELLE, President of the *Associazione Nazionale delle bonifiche* : Results of constructive land betterment schemes (*bonifica integrale*) in relation to the Exhibition and the Congress.

The Congress opened with the Lecture delivered by His Excellency Sig. PEGLION, Under Secretary for Agriculture to the Ministry of National Economy, on " Land Improvement and Fisheries ", followed by His Excellency Sig. BELLUZZO of the Milan Polytechnic and Minister of National Economy, on the Progress, in the Use of Hydraulic Machinery in Land Improvement : this latter illustrated by slides.

Other subjects treated were : Professor ASIMONTI : Land Improvement Large Scale Schemes in the South of Italy. Economic, Technical and Demographic Considerations as influencing procedure ; Prof. D. TOLLA : Improvement of Mountain Land and the Treatment of Mountain Catchment Areas ; Avv. A. SULLAN : Private Improvement Schemes ; Ing. P. CASINI : Irrigation in the Improvement Zones of the South of Italy ; Prof. G. GOSIO, Director of the Bacteriological Laboratory of the Department of Health : Improvements and Malaria ; Prof. GIANDOTTI : Hydrographical Work in relation to Improvements ; Prof. F. BREDIA : Meteorological observations in relation to enquiries in view of Improvement Schemes ; Prof. G. BRIGANTI : Fruit-Growing ; Prof. MAROZZI : Legislation on Land Improvement and Reclamation.

Seven groups of conclusions were submitted for the approval of the Congress: the greater part referring to legislative provisions on agricultural credit in connection with the improvement carried out by private persons ; another making request for study of irrigation and experimental plots in connection ; others referring to the diffusion of information on the methods of combatting malaria and of securing the hygienic condition of rural buildings. The most important resolutions, however, were those on legislation relating to land improvements, and certain amendments of the SERPIERI legislation are invited, more particularly that expropriation of lands be carried out only as against those landowners who do not propose to make improvements on their lands, although there are special reasons for doing so of which due notice has been given ; that an association (*consorzio*) of landowners has prior right in the matter of concessions for improvements of areas : that notifications, whether of the scheduling of an area for improvement, or of the application for a concession made by third parties or of any matter which may concern the land-owners in this connection, shall be made to the owners by recognised legal means.

During the Congress more than thirty publications were distributed with reference to improvement schemes, already carried into effect by various bodies. The report of the Congress will be published by the *Federazione Nazionale delle Bonifiche* (Padua, Via Manin 14).

972. **Italy : " Convegno del pesco ". Canale d'Alba, Cuneo, 16-19 July 1925.** — The following subjects were discussed : Prof. C. REMONDINO : Peach products in the present and in the future ; — Prof. G. BELLUCCI : The cultivation of the peach in the Ravenna district ; — Prof. D. ALLEGRI :

The cultivation of the peach in Liguria ;— Dr. BARBARA : The varieties of the peach and their characteristic advantages for trade or manufacture ; — Prof. BOGLINO and FERRARIS : Diseases of the peach tree and treatment ; — Dr. FERRIO : The fertilising of the peach ; — Comm. CASSON : Commercial possibilities transport and packing ; — Comm. CANONICA : Preservation, marketing conditions and foreign competition. Industrial use of the peach. Local transport, shortage, measures adopted.

On the occasion of the Conference a Sample Fair was also organized of the products of the district. For further information apply to the Cuneo Chamber of Commerce and the provincial agricultural authorities.

973. **Italy : Industrial Week of experts and persons engaged in the Chemical and allied Industries. Turin, June, 1925.** — The occasion of this was the National Exhibition of Pure and Applied Industrial Chemistry, held also in Turin in May and June last. In alternation with the meetings, visits were paid to industrial establishments and the programme was divided into six sections: 1. Breadmaking, milling; 2. sanitation industries; 3. leather industries; 4. oils and derivatives, synthetic resins, essences, perfumes; 5. textile and dyeing industries; 6. wine-making. As regards the three sections directly connected with agriculture, the principal subjects treated and papers read were the following : Ing. F. PAGLIANI : Cleaning of grain by decortication ; — Prof. Dr. S. CAMILLA : The Need for the establishment of a Royal Experiment Station for Food Industries at Turin ; — Prof. Dr. C. REMONDINO ; Gathering and Distillation of Wild Aromatic herbs ; — Prof. A. PAROZZANI : The work of the Royal Experiment School for the manufactories of essences and derivatives of citrus fruits in Reggio Calabria, and for the preparation of the essential oils ; — S. E. T. ROSSI : The activity of the Subalpine Wine makers' Club (*Circolo enofilo subalpino*) in its fortieth year of existence ; — A. MARESCALCHI : Importance and future prospets of export of Italian wines ; — Dr. E. GARINO-CANINA : Wine vinegars : contribution to the chemical study of the acetic fermentation of wine ; — Prof. P. VOGLINO : Phylloxera and its spread in Italy ; — Prof. G. CHIEI COMACCHIO : Wine-making ; — Prof. Dr. F. GARELLI : Possibility of producing alcohol as a beverage from the residues of wine-making ; — Dr. G. VANNI : Sweet filtrates.

For information apply to Dr. MASSIMO TREVES, General Secretary of the "*Settimana industriale*", Via Ospedale 20, Turin.

974. **Italy : Congress on Vines and Wine. Trento, 24 June 1925.** Ing. GRAMATICA and Dr. ZUFFMANN presented reports on general enological subjects and on special treatment of wines investigated by the Experiment Station connected with the Agricultural Station of S. Michele all'Adige (Trento). — Prof. G. BONI dealt with the restocking of vineyards with the European varieties on American stock, and M. GENNARO DE KRENHENBERG spoke on hybrid wines for breeding.

975. **Italy: National Congress of the Sugar and Alcohol Industries. Ferrara, 31 May 1925.**

976. **Italy: Third National Congress of Tobacco Growers. Bologna, 25 May 1925.** — This Congress was called by the Italian Federation of Agricultural Syndicates. The members of the Congress considered it essential to invite the Government to establish and bring into speedy operation,

centres for experimental work in districts where the cultivation of tobacco stands in need of such centres, and particularly in the valley of the Po, the largest and most recently developed centre of production. In addition, the Minister of Finance should place persons who have obtained tobacco concessions in a position to meet the requirements of the Italian manufactures, by means of an increase in technical staff and in other ways. Later on a vote was passed for the formation of a tobacco export Company and a further meeting will be called to arrange its organization. (*La Terra,* Year 1, No. 6, Bologna, 1925).

Exhibitions, Fairs, Competitions.

977. **Italy: International Competition of Viticultural Machinery, Barletta.** — The Minister of National Economy announces an international competition, open to makers of implements and machines adapted for the planting and cultivation of vineyards. The competition will be held at the *Barletta Cantina Sperimentale* from 15 April to 15 June 1926. Applications for entry must be addressed to the Director of the Barletta *Cantina Sperimentale,* not later than 31 January 1926.

978. **Argentina: International Exhibition of Hygiene, Art and Industry. Rosario, 5 December 1925, 5 March 1926.**

979. **Cuba: International Sample Fair, Havana, December 1925.**

980. **France: International Exhibition of the "Société des Aviculteurs du Nord". Lille, France, 12-14 December 1925.** — For information, M. René Parent, 32 bis, rue du Vieil-breuvoir, Roubaix (Nord).

981. **Great Britain: British Empire Exhibition, Wembley Park. London, April to October 1925.** — For information: Director United Kingdom Exhibits, Administration Buildings, Wembley.

982. **Belgium: Eighth International Poultry Fair, Brussels, 5 to 7 September 1925.** — This fair was organized under the auspices of the city of Brussels and under the honorary presidency of the Deputy Maenhaut, President of the International Poultry Federation. A well equipped commercial section, the object of which was to encourage the outturn and the improvement of all material and fittings, required for the poultry industry, displayed a large number of stands of special kinds of feeds, as well as those in ordinary use. For information apply to the Secretary of the Organising Committees. of the *VIII*ème *Foire internationale avicole,* 365, Chaussée d'Anvers, Bruxelles.

983. **Bolivia: International Manufactures Fair. La Paz, August 1925.** 1925. — Organised on the occasion of the centenary of the Bolivian Republic.

984. **Fifth International Exhibition and Fair, Riga, 19 July-31 August 1925.**

985. **International Sample Fair. Bandoeng, 20 June-4 July 1925.** — For particulars: Nederlandsch-Indisch Jaarbourg, Menade Straat, Bandoeng.

986. **France: International and Colonial Sample Fair. Bordeaux, 15-30 June 1925.** — For particulars: Comité organisateur, 7, Rue du Maréchal Joffre, Bordeaux.

987. **Second International Book Fair Florence, 30 June 1925.**

988. **Italy: First International Exhibition of the Gas and Water Industries. Padua, June 1925.** — Held on the occasion of the 51st Congress of the Italian Gas and Water Companies.

989. **Finland: Sixth International Finnish Fair. Helsingfors.** — For particulars: Finlandska Massa A.B. Frederiksgatan 14, Helsingfors.

990. **Germany: XXXIst Travelling Exhibition of the German Agricultural Society, Stuttgart, Wurttemberg, 18 to 25 June 1925.** — The *Deutsche Landwirtschafts-Gesellschaft* which has undertaken to organize every year a show of live stock, agricultural produce, farm implements and machines, in different localities in respective years, held its "40th Travelling Meeting" in Stuttgart in June last, following, as usual, the headquarters of the travelling exhibition. Wurttemberg is the birthplace of the founder of the Society, MAXIMILIAN EYTH, who in 1896 organized and managed the first exhibition of the Society in Stuttgart.

On the occasion of this 31st travelling Exhibition the *Münchner Neueste Nachrichten* has published a special supplement with a number of articles, among them one by Ing. FRITZ BRUTSCHKE (Zehlendorf, Berlin) giving an account of the activity of the *Deutsche Landwirtschafts-Gesellschaft* in regard to these travelling exhibition and the practical results obtained.

Another article is by Dr. FELIX JALK on agriculture in Wurttemberg; and another by the advisor to the Ministry, PAUL SÜSKIND, on the promotion of stock-breeding in Bavaria. A fourth is by the Advisor to the Ministry, Dr. NIKLAS, on the stock-breeding industry in South Germany, and two further articles are respectively by Dr. LANG of Munich, Chief Advisor to the Ministry, on the instruction in agricultural machinery given in Bavaria, and by CHRISTMANN, Director of the Bavaria Institute for Plant Cultivation and Protection, on the progress in technical agriculture. (*Münchner Neueste Nachrichten*, No. 166, 17 June 1925)'.

991. **Austria: Fundamental Criteria for the Judging and Awarding of Prizes to Cattle in Lower Austria.** — Up to lately periodical judgings of bulls and calves have been carried out at all the stock-breeding centres in Lower Austria. Every owner of stock had the right to present his animals for inspection, even if they were not bred by himself. Only one or another of the head of cattle presented were examined, and when the stock from a given farm failed several times to come up to the standard required by the Judging Committee, recognition was refused.

This form of cattle show viz. exclusively for calves, is now altogether given up, as it was considered that, in the absence of evidence as regards progeny and functional aptitudes, the judging tended to be based purely on conformation and thus not infrequently led to disappointment at a later period of the animal's history. Hence, at the present time instead of calves only, there are presented for examination young and full grown animals, cows, beef cattle, and heifers. Only animals registered in herd-books and their descendants can be approved.

In this way it becomes possible, as it was not before, to judge and form an estimate of the stock-breeding farming activities of each member of the association. There is in addition a new prize award scheme, which brings into more prominence the evaluation of hereditary characteristics and facilitates the

awarding of the prizes in classes corresponding to the points of the animal shewn.

Prizes are being awarded by the Lower Austrian Chamber of Agriculture and the Federal Ministry of Agriculture: and alsc there will be prizes given by the rural district chambers, the associations and the Communes: these will however be of less value than those given by the two first named bodies. The judging is carried out by a sworn Committee appointed for the purpose. Farmers who have an official position in the association or reside in the administrative area of the association cannot sit on this committee. Members are proposed by the Lower Austria Chamber of Agriculture and the Provincial Government appoints a member in its turn.

For the awarding of prizes note is first taken of the evidence produced by the exhibitor in respect to the progeny and the functional aptitudes of his animals and only after that is judgement given on each animal and in accordance with a given scheme, established by Decree of the Provincial Government on the basis of the Law on the promotion of stock-breeding. This scheme provides for four groups, further divided into sub-groups, represented on the following table in regard to the maximum number of points obtained.

Head and Neck	5
Back Line and width of back	4
Forequarters, width of chest behind the shoulders barrel, shoulders	4
Hindquarters, croup, width of thigh, muscles, sex organs	4
Length of body	5
Structure of limbs and general bearing	4
Skin and hair	3
Milk-yielding aptitude	14
Meat producing aptitude	8
Work aptitude	8
Breed and coat	5
Progeny	10
Condition of health and constitution	8
Development	7
General impression	10

Animals obtaining more than 85 points receive the first prize, those obtaining from 80 to 85 points receive the second prize, and cattle with 70 to 80 points receive the third prize. For animals for which there is evidence forthcoming, authenticated by the Association, in respect of the sire and the dam, and evidence, similarly supported, as to the milk-yielding capacity of the dam, for at least two years, the owner receives an extra prize of 25 %, given by the Provincial Chamber of Agriculture. The prize is subsequently increased by 50 %, when the breeder can bring forward evidence in respect to the pedigree of the animal presented.

The acceptance of the prize binds the breeder to devote the animal presented to breeding purposes for the space of at least two years. Young prize

bulls must be sold only to farmers or Communes who undertake to place them at the disposal of the public breeding stations in the territory of Lower Austria for the space of at least one year.

The lower Austrian Chamber of Agriculture has the exclusive right of purchasing animals winning the prizes it awards. If the exhibitor puts the animal to uses other than those to which he is bound by the award, he must restore the prize, and also incurs a fine equal to half its value. The object of this proviso is to prevent the breeder from selling the animal and to oblige him to use it for the purpose of improving the breed.

In addition to these prizes for individual animals, others are offered for whole families of animals shown : the cow and at least five descendants. Each exhibitor may claim for his animals of one group only one prize, but for any remaining animals that reach the prize standard he may receive a certificate stating the nature of the prize they would have taken.

Besides these approval exhibitions, others are organized for bulls, and the special purpose of these is to provide a classification of the stock for the Stock-Breeding Committees, and to afford the Communes the opportunity of purchasing approved and prize animals for service uses. As regards organization and the award of prizes the same rules are followed in these exhibitions as in the former kind. The acceptance of a prize binds the breeder to devote his bull to breeding purposes only for a period of at least a year, or to hand the animal over only to an individual purchaser or organisation which will undertake to put it for the period of at least six months to the disposal of the public breeding stations of the territory of Lower Austria. The total amount of the prizes is fixed year by year by the regional Chamber of Agriculture.

This new scheme for approval of cattle has been very generally adopted in Lower Austria, although imposing much stricter conditions on the breeders than formerly. (STAMPEL Prof. of Alpine Cultivation at the Vienna Higher School of Veterinary Science: reporter on Stock-breeding to the Lower Austrian Chamber of Agriculture. Genossenschaftliche Rinderschauen in Niederösterreich. *Die Landwirtschaft*, No. 1, Vienna, 1925. — Bestimmungen über die Abhaltung von Rinderschauen in Niederösterreich. Grundsätzliche Weisungen herausgegeben von der Landes-Landwirtschaftskammer in Wien, 1924).

992. **Austria : The part taken by agriculture in the Vienna Fair and the Principles regulating it in Lower Austria.** — The Lower Austrian Chamber of Agriculture has since the autumn of 1923 taken a definite part in the organisation of the Vienna Fair both as regards the sectional and the special exhibitions. On the basis of the experience so gained, the following principles have been laid down for participation in future fairs.

1. The organisation of an agricultural and forestry exhibition is essential for the development of Austrian agriculture ;

2. The arrangement in the separate sections should be such as to illustrate clearly the aim of facilitating the marketing of produce, the locality from which the exhibit comes being a secondary consideration ;

3. With a view to inducing farmers to take part in the exhibition and to general encouragement of agriculture, special competitions and prizes will be arranged in the separate sections;

4. So far as proves possible the exhibition is to be extended to the separate branches of the stock-breeding industry on the larger scale, thus including competitions for cattle and horses, the exhibits of live stock having been so far confined to rabbits and poultry.

5. Products of special excellence in one or other field of rural activity will receive appropriate certificates of merit, granted by the Chamber of Agriculture in accordance with the proposals of the competent committees;

6. As a basis of action, arrangements will be made for the supply at the Fair of special information, particularly in respect to demonstrations of implements and machines, lectures, lantern slides, cinematograph displays bearing on agriculture, to be given or held in the premises of the exhibition;

7. By agreement with the holder of the Chair of Agricultural Mechanics at the Vienna Higher School of Agriculture, competitions will be held annually for groups of machinery (in 1924 one will be organised for spraying machines) which after approval will be on show in the exihibition;

8. Special stands will be assigned for the display of these exhibits.

The Lower Austrian Chamber of Agriculture has decided to concentrate interest as regards exhibitions, solely on the Vienna Fair, promoting only in exceptional cases small exhibitions in separate districts, which usually only result in dissipation of energy. (LOSOBNIG, reporter for fairs and fruit-growing to the Lower Austrian Chamber of Agriculture. Referat über landwirtschaftliches Austellungswesen in der Vollversammlung der Landeslandwirtschaftskammer am 30 Oktober 1924. *Mitteilung der Landeslandwirtschaftskammer*, No. 7, 24 November 1924, 2 pp., Vienna).

993. **Brazil: Agricultural Livestock Exhibition, 1925.**

994. **Brazil: 1st Exhibition of Milk and its Derivatives, St. Paul, 12-20 October 1925.** — Organised through the initiative of the National Society of Agriculture.

995. **Bulgaria: Stock Breeding Exhibition. Rasgrad, Autumn, 1925.** — Organised by the Permanent Committee of the Departmental Council of Roussé.

996. **Chile: Pomological Exhibition, Santiago, March 1925.** — Through the initiative of the Agricultural Society and with the help of the Chilean Ministry of Agriculture.

997. **France: VIth Competition for the finest ear of corn in France. Bordeaux, October 1925.** — Three sections: very early variety, early variety, late variety. For particulars apply to: 6th Competition for the finest ear of corn in France, Palais de la Bourse, Bordeaux.

998. **France: Exhibition of Agricultural Tractors. Buc, Versailles, 29 September to 4 October 1925.** — By decree of 11 June 1925 the French Ministry of Agriculture arranged an exhibition of agricultural petrol tractors; of agricultural gasogene, charcoal and wood tractors and motors; of military gasogene trucks and tractors, of apparatus for the manufacture of charcoal in forests and on the farm, of vegetable oil motors and electric cultivators. The Exhibition was organized by the Ministry of Agriculture (Central Committee of Mechanical Agriculture) with the collaboration of the Ministry of War and the Departmental Agricultural Office of Seine and Oise.

999. **France: The Lower Rhine Horticultural Exhibition Strassburg, June 1925.** — Organised through the initiative of the Société d'Horticulture du Bas-Rhin, which has celebrated its 80th anniversary.

1000. **France: Gastronomic Fair. Havre, 11-20 April 1925.** — The fair has, among other things, demonstrated particularly the important progress made in France in the refrigerating industry applied to the preservation of food.

1001. **France: Competition for the selection of the black spotted Breton breed for the Departments of Finistère and Morbihan (France), 1925.** — This competition has been organised by the Agricultural Academy of France by means of the bequest of the late Baron GERARD. For particulars as to the bequest see the *Current Notices* of the last number of this Review.

1002. **Great Britain: Textile Machinery Exhibition. Manchester, 2-17 October 1925.** — For particulars apply to *Organisers of the Textile Machinery and Accessories' Exhibition*, 121 *Deans Gate, Manchester.*

1003. **Great Britain: Annual Sanitary Exhibition. Edinburgh, 20-25 July 1925.** — In conjunction with the 36th Congress of the Royal Sanitary Institute (90 Buckingham Palace Road, London, S. W. 1).

1004. **Great Britain: National Commerce Exhibition. Liverpool, 6-25 July 1925.** — For particulars apply to: L. BATLEY, Esq., Gorsey Works, Stockport.

1005. **Canada: Canadian National Exhibition. Toronto, 25 August to 12 September 1925.** — For particulars apply to: The Secretary, Lumsden Buildings, Toronto, Canada.

1006. **Italy: National Land Improvements Exhibition. Naples, August 1925.** — This Exhibition was organised, by a resolution of the Council of the Ministers, on the proposal of the Ministry of the Public Works, the Hon. CIURIATI, of the « Federazione Nazionale delle Bonifiche ». For particulars apply to: Federazione Nazionale delle Bonifiche, Rome, Piazza San Marcello (Galleria), or Padua, Via Daniele Manin 14.

1007. **Persia: Agricultural Exhibition. Teheran, August, 1925.**

1008. **Czecho-Slovakia: Agricultural Exhibition. Prague, 15-21 May 1925.** — Interesting on account of the introduction of agricultural machinery which occupied more than half the Exhibition space out of a total of about 5 acres. 2,000 people took part in addition to 360 delegations, and 40,000 people visited the Exhibition.

1009. **Turkish Floating Exhibition, sailed July 1925.** — Organised on the " Kara Deniz ", the largest steamship of the Sefain Navigation Company. Called at the principal ports in the Mediterranean, England and the two Americas. Among the products exhibited and of interest to agriculture were: cotton, tobacco, olives, nuts, figs, grapes, dried fruits, sesame, opium, attar of roses, honey, forest products.

Development of Agriculture in the different countries.

1010. **Austria: Reafforestation in Lower Austria.** — During the war and the difficult years which followed, there was much disafforestation. Owing to the shortage of young trees, and owing to the fact that disafforested tracts

had been given over to pasture, reafforestation was necessary over vast areas. The Lower Austrian Chamber of Agriculture, in order to remedy the shortage and to meet the threatened danger of depletion of the forest regions, has established new nurseries, and revived and enlarged those already in existence, so that at the present time it is able to supply forest trees at production cost. Proprietors of small woods who undertake to reafforest bare and sterile lands under the direction of competent persons, and to give them up entirely to forest culture and hence to protect the forest species, receive grants from the Chamber of Agriculture of firs, larches, pines, acacias, ash-trees, alder-trees 2 or 3 years old. When a sufficient number of trees are available, there will also be a distribution for the purpose of improving regions insufficiently wooded. It is hoped during the next few years to develop further the work of reafforestation, which is of such importance in the reconstruction of forests. (ADAM, public advisor and reporter for forest culture to the Lower Austrian Chamber of Agriculture, Waldplanvenverteilung 1925. *Mitteilungen der Landeswirtschaftskammer*, No. 7, 4 November 1924, Vienna).

1011. **Development of Agriculture in Brazil in 1924.** — *Coffee*: The cultivation of this product is always of great interest to growers, on account of the high prices at which the crop is quoted. Large numbers of workers also are attracted by the amount of work offered, and by the richness of the regions under coffee plantation, and a considerable migration of labour thus takes place. The 1924-25 crop is, however, less than those of previous years, being estimated at 755,075,000 kilos, while in 1923-24 it rose to 874,135,839 kilos and, in 1922-23 to 1,140,435,445 kilos. In the States of S. Paulo, Parana, Minas, Rio de Janeiro, Espirito Santo and Bahia, new coffee plantations have been established, thus increasing the area given up to coffee. This area would be still larger, if more labour were available. Great anxiety is shown to profit by the present favourable moment, occasioned by the high value of the product. *Stephanoderes coffea* appeared in the State of S. Paulo, but was successfully controlled by direct as well as by prophylactic measures.

Sugar : The technical problems of the sugar industry are suffering from want of a definite policy. The improvement in the equipment of the factories finds no parallel in the improvements on the agricultural side, which would be inseparable from the introduction of new varieties of canes richer in saccharine properties, more productive, and more resistent to disease and infection.

Rice : The last crop was somewhat inferior to those preceding. The Central states suffered from a prolonged drought, and irrigation is not yet generally adopted. Throughout Brazil half a million hectares are under rice, and it is calculated that the production of 1924 was about 770 million kilos.

Tobacco : The cultivation of this plant was not very satisfactory owing to insufficient rains. Bahia continues to hold first place, especially for leaves grown for exporting. In Rio Grande do Sul plantation of high-grade varieties are being extended, and the amount exported is therefore increasing.

Cocoa: The State of Bahia holds first place in the growth of this crop, but the production cannot be adequately developed without more labor and in the absence of agricultural credit. The State of Bahia comes next, but far behind, and then the State of Espirito Santo, where cocoa plantations are being established along the valley of the Rio Doce.

Rubber : In view of the high prices of this product, interest is being directed to an investigation of Brazilian rubber, especially after the optimistic Report of the North American Commission which went to Brazil in order to study the whole question.

Wheat : The area under cultivation is increasing. The Government has taken action to promote the selection of seed and the introduction of exotic varieties which are more suitable to the different regions of Brazil. To this end there are two special experiment stations one in Parana (Ponta Grossa), and the other in Rio Grande do Sul (Alfredo Chaves). The latter is under the direction of a Swedish tecnician, Doctor IVAN BECKMANN, late of the Institute at Svalof, who was invited by the Brazilian Government to direct the work in cereal genetics.

Rye : The cultivation of this crop is increasing, especially in the States of Parana and Santa Catharina, where conditions are very favorable.

Vines : Cultivation continually increasing. (Mensagem apresentada ao Congresso Nacional na abertura da segunda sessão da decima segunda legislatura pelo Presidente da Republica ARTHUR DA SILVA BERNARDES. *Diario Official*, May 1925).

1012. **Brazil : Coffee Plantations in the State of São Paulo.** — Following the official data contained in the publications of the Agricultural Secretariat and more especially in 2 volumes "O café" and "Os municipios paulistas", the *Gazeta da Bolsa* of Rio de Janeiro (VIII, No. 7, 1925) has compiled 2 tables of data, which show that in the ten-years period between the agricultural seasons 1913-14 and 1922-23, there were in the State of São Paulo 54,200,000 productive coffee plants, while 16,200,000 plants became unproductive.

1013. **Brazil : The Coffee Plantations of Parana.** — Signor E. GRILLO, assistant to the phytopathological service of the Institute for the Protection of Agriculture (*Istituto de Defensa agricola*), acting under instructions from the Federal Ministry of Agriculture, has carried out an investigation in the coffee plantations of the State of Parana with respect to the existence of the *Stephanoderes coffeae* Hag. The insect was not found ; the season was not however particularly appropriate for such an investigation, since the fruit was still very unripe, and did not offer a favorable environment for the *Stephanoderes* in its different phases. However, the appearance of the parasite is reported in the State of São Paulo, and a service of disinfection is proposed at the frontier, for all sacks passing from this State into Parana, as well as measures for the protection of coffee based on those proposed by the entomologist Doctor CARLO LIMA for the State of Espirito Santo. *A Gazeta da Bolsa*, VIII, No. 9, 1925 publishes the report drawn up by GRILLO on this inspection of the coffee plantations of Parana.

1014. **Hong-Kong : Camphor Plantation.** — The Department of Forestry of Hong-Kong is entering upon an enterprise of great interest, *viz.* a camphor plantation. For this purpose a small valley near Little Hong-Kong is being utilised which has hitherto borne a nearly virgin forest. All the trees which are fit only for timber are being cut out. Some very fine mature specimens of *Bischofia javanica* are to be seen. There are also many splendid trees of a

wide-leaved species of *Cinnamomum* reputed to be very productive of camphor gum. (*Lingnam Agricultural Review*, Vol. 2, No. 2, Canton, 1924).

1015. **India: Progress of Cultivation of Improved Varieties of Crops.** — In the annual report of the Agricultural Advisor to the Government of India he states that the area under cultivation with improved crops has increased in the relatively short period of 18 years from some thousands to millions of acres. In 1923-24 five million acres were under cultivation with improved crops originally selected by the Agricultural Department, *viz.* 606,603 acres for rice; 1,398,885 acres for wheat; 50,604 for sugar-cane, 2,438;882 for cotton; 210,262 for jute; 467,146 for other crops. Allowing an additional profit per acre of 10 rupees, obtained by the adoption of these improved varieties, it is reckoned that the annual value of agricultural production in India is increased by three and a half millions sterling. It is hoped to obtain an even larger additional profit in the future. (*The Times Imperial and Foreign Trade and Engineering Supplement*, Vol. XVI, No. 356, 1925).

1016. **Nyasaland: Note on Cotton Growing.** — 1. *Times of planting cotton*: (*a*) Lower Shire Districts: Elevation below 1000 ft. above sea-level, mid-January to mid-February.

(*b*) Upper Shire and Lake areas. Elevation 1000 ft. to 1800 ft. above sea-level: beginning to middle of January.

(*c*) Palombe plain and similar elevations of 1800 ft. to 3000 ft. above sea-level: beginning to end of December.

2. *Times of picking*: (*a*) and (*b*) get two flushes of fruiting (bolling) in normal years: the first in June to July, though some years earlier than this; the second in October to November.

In the intervening period which corresponds with the coolest and driest months of the year, the plants lose their leaves and acquire a new set.

(*c*) Normally, only gets one flush, the second flush, on account of the colder conditions, being too late to allow it to be picked in time for the land to be cleared and cultivated for the next crop. On an average of seasons the difference in yield between the above mentioned areas is in favour of (*b*) and (*c*), but not to the extent which might be imagined from the natural advantages they possess, the boll-worm and the internal boll disease restoring the balance.

3. *Labour conditions, supply and quality*: Labour, except during seasons when the natives are engaged with their own food crops, is plentiful, and the food supply is normally very good.

The African native is only now arriving at the stage of thinking in terms of regular work.

Under the European employer the "Task" system is nearly universal and this does not lead to efficiency. The native, with his own crops, is too apt to procrastinate and the crops suffer in consequence.

4. *Transport*:—

(1) Railway from the Shire Highlands to Port Herald.

(2) Central African Railway from Port Herald to Chindio on the Zambezi.

(3) Ferry across the Zambezi.

(4) Trans-Zambesia Railway to Dondo Junction on the Beira-Mashonaland Railway.

(5) And by the latter railway to Beira and to the sea.

This complex and unwieldy system forms the main line of egress for the produce of the country.

It is liable to more or less complete stoppages when the Zâmbezi floods each year and is at all times handicapped by the lack of proper harbour facilities at Beira, the present arrangements being easily overwhelmed by the traffic: the said traffic being that of the Rhodesia and part of the Congo besides that of Nyasaland. The Railway in Nyasaland is fed in three ways:

(1) Head transport.

(2) River transport (Lower Shire only)

(3) Road transport (subdivided into: (*a*) Ox-cart transport; (*b*) Mechanical transport).

All the above have their uses and their limitations:—

(1) is becoming unpopular with the natives;

(2) is limited to the time when there is sufficient water in the river to float the barges, i. e. in the rains or just after;

(3*a*) is slow, and impossible wherever tsetse fly occurs;

(3*b*) is expensive in vehicles, their upkeep and the running expenses.

The time taken from Plantation to Port is a most elastic period, everything depending on the weather, time of year, traffic on the Beira-Mashonaland Railway, etc.

The shortest possible time on rail for goods is about 5 days: and the longest is indefinite: the writer has had to wait six months for a motor-cycle to come up from Beira.

5. *Prevalence of the Red Boll-worm* (*Diparopsis castanea*). — This pest occurs, together with the American Boll-worm and the Spiny Boll-worm, throughout the Protectorate, ranging from an elevation too high for the productive growing of cotton to the lowest elevations in the country, 150 ft. or so above sea-level. The Red Boll-worm is a pest occurring throughout the season, but mainly in the early part, i. e. in the muggy moist weather. The American Boll-worm is more a late season pest, since while other crops are green, it seems to prefer them to cotton. The Spiny Boll-worm occurs in larger or smaller numbers throughout the season. All pests however fade into insignificance beside the Red Boll-worm.

6. *Characteristics of Nyasaland cotton and expected improvements from the work in progress.* — The present commercial bulks of Nyasaland cotton are the degenerate descendants of a number of introductions of the Allen Long-staple type of Upland cotton. Apart from their objectionable characters from a crop point of view, e. g., small bolls, large, long-jointed, straggly plants, etc. they are undesirable from a lint point of view. Very few bulks will gin more than 29 % to 30 % and even with this low ginning percentage much of the seed is very light, i. e. below 10 grams per 100 seeds. The lint length is very irregular in the same sample, in most cases ranging from half an inch to one and a quarter inch. With the large amount of rotting due to boll-worm and to internal boll-rot, much of the lint tends to be weak.

It is expected that from the large collection of new introductions and se-

lections of Nyasaland cotton which have been accumulated it will be possible to separate out a strain, or strains, which will yield better than the existing bulks of commercial cotton in the country. It is too early to prophesy yet what the value of rotation crops may be.

7. *Advantages of the rough leaf and hairy type of plant over the existing type.* — A decided resistance to Jassid attack; smooth plants as soon as the leaves appear, redden and dry up with the onset of the dry season. Over those plants of the existing type that are hairy there is of course no advantage from this point of view. (*Correspondent Nyasaland*).

1017. **The Oil-Palm Industry and West Africa.** LUGARD, Sir FREDERICK (G. C. M. G., C. B., D. S. O). *Tropical Agriculture*, Vol. II, n. 6, pp. 119-121, Trinidad, 1925.

The author draws attention to the oil-palm industry of Nigeria and the danger with which it is threatened, in common with all similar tropical countries, owing to competition from the East, particularly the Dutch Colonies.

Recent estimates give the annual output of West Africa (exclusive of the Congo) at 430,000 tons of kernels and 180,000 tons of oil, valued at £ 12000,000.

The wild rubber industry was destroyed by the plantation rubber of Ceylon, Malaya and the Dutch Colonies.

The Dutch Colonies have successfully introduced the oil-palm; 600,000 acres are planted and 15,000 bearing. The danger lies in the fact that the yield per tree is greater than in Africa, and a larger amount of oil of better quality is extracted, owing to the employment of scientific methods and organization. These methods contrast with those of the African native who is unable to understand the conditions of modern world competition.

If means could be found, without violation of native rights, to increase and cheapen this source of food supply and raw material for industry, no effort should be spared to achieve such a result.

The objects in view are :—

To save a threatened industry by the adoption of methods which will enable it to stand competition.

To preserve for human use the millions of tons of valuable produce now uncollected, or wasted by crude methods of preparation.

To increase output by converting to productive work the labour now wasted in archaic methods of transport and preparation of the oil.

To devote to native welfare a portion of the profits of the capitalist, and possibly by clearing, etc. (planting of efwatakala grass), to decrease the areas subject to tsetse-fly and the diseases (sleeping-sickness and cattle disease) of which it is the carrier.

1018. **Roumania : The Development of Agriculture in Roumania as a result of Agricultural Reforms.** — These reforms, which caused a complete change in the distribution of cultivable land have had a very favorable effect on agricultural production, according to the last official figures (1924). Both the yield and the quality of the wheat have improved, while the yield has increased in the years 1919-23 from an average of 8.39 to an average of 10.3 quintals per hectare. Live stock production has increased 19.93 % within the same period. The quantity of crop and live stock products exported also in-

creased considerably, namely, from a value of 34 million *lei* (in round figures) in 1919, to over 9 miliard *lei* in 1922.

The large estates, which, previous to the reforms, comprised 48 % of all cultivable land, only form 8 % at the present time, and the number of small holdings has doubled from 40 % to 80 %. (*La Réforme agraire en Roumanie et ses résultats d'après les derniers chiffres officiels fin 1924*, 1 vol., 23 pp., small 8º, Bucarest, 1925).

1019. **Czecho-Slovakia : The improvement of Pasture Lands in Slovakia.** — In Slovakia 12.43 % of the total area of the country is devoted to pasture, and in half of the old Slovak Komitäts pasture forms 25 % of the total cultivable area (40.9 % in the Komität of Liptov). The largest pasture areas are to be found in the Komitäts of Zemplin, Trencin, Sarys, Liptov, Gemer, M. Hont (to an extent of 88,542 hectares in the Komität of Zemplin).

Land is so valuable in that region that farmers are obliged to graze their animals on the less fertile tracts, which are generally mountainous.

In 1919, through a decree issued by Minister SROBAR on the utilization and improvement of pasture lands, an attempt was made to convert into pasture all lands that were not being put to more profitable use. This decree was renewed every year, but has now become law, having effect from 1924-1929. By this law farmers are required to pay a tax for the use of pasture lands, and regulations have also been made with respect to the upkeep and improvement of private pasture lands.

The Ministry of Agriculture grants subsidies towards improvements, aids farmers in the purchase of seeds and artificial manures, and loans machinery when required. Before granting subsidies, however, an inspection of the lands in question is carried out by the competent State authorities. Five experts have also been employed for this purpose since 1924, who are assisted by agricultural inspectors in each Komität. It is impossible for financial reasons to grant all the requests for subsidies, but considerable progress has been made towards the improvement of the pasture areas of the country. (*Publication du Ministère de l'Agriculture de la République Tchécoslovaque*. Prague, 1 May 1924).

Miscellaneous.

1020. **Brazil : The "Babassu" and Derivatives Industry.** — According to the periodical *Brazil-Ferro-Carril* (Year XVI, Vol. XXVIII, No. 396, 1925) the Maranhao papers are reporting the progress of the factory established there for the preparation of the babassu nut by means of the mechanical oil-presses known as "Brito Passos". Derivatives are also prepared, the use of which was not formerly known, among them a kind of flour which should be much in request for the feeding of dairy cows, owing to its richness in nitrogen and phosphates.

1021. **Brazil : Dictionary of the Valuable Plants of Brazil.** — This is a work which Dr. PIO CORREA, a well-known Brazilian scientist, began to compile in 1905 and which therefore represents the result of many years of assiduous labour. It will eventually consist of eight volumes, in octavo, with more than 900 illustrations in the text and about a thousand diagrams in an appendix. The first volume has just appeared and will form an addition to

the number of works of reference which are indispensable to the science of botany and especially to systematic botany. The edition is the exclusive property of the Federal Government of Brazil, which is regulating the sale.

1022. **Chile : Nitrate Costs.** — As a result of the growing competition of the synthetic nitrogenous fertilisers with Chilean nitrate, the Minister of Finance in Chile has called a meeting of nitrate producers in order to discover means of reducing costs of production to meet this competition. It has been suggested that economy could be effected by improved mechanical plant, better preparation and transportation methods, better facilities at the ports and co-operation between the producers and the State. (*Chemistry and Industry*, Vol. 44, No. 21, London, 1925).

1023. **International Scientific Tables.** — Dr. CHARLES MARIE, general Secretary of the International Commission, charged with the compilation and publication of "*International Annual Tables of Constants and Numerical Data, Physical, Chemical and Technological*" announces the publication of Vol. 5, Part I. This volume gives the numerical data which characterize any substance, material, or system, which are to be found in the world's literature for the period of 1917-1922, inclusive, and covers the sciences of physics, chemistry, mineralology, biology and the various branches of technology. Owing to the immense increase of modern scientific literature, these volumes will be of great value to the scientist. They give not only the data as they appear in the original literature, but also the corresponding literature reference for every value recorded.

This international undertaking is carried on without profit and is made possible by the financial support of governments, scientific societies and educational institutions which contribute to the international fund. Members of scientific organisations and of the faculties of universities which help in this way to make possible the compilation of annual tables are accorded a special discount on purchases of these volumes. (*Science*, Vol. LXI, No. 1576, 1925).

1024. **American Bibliography of the Natural Sciences.** — The first volume has been published in New York of a bibliography containing particulars of what has been accomplished in the field of the natural sciences beginning from the colonial period up to 1924. The subjects treated include the work done by the scientific associations, by natural history museums, botanical gardens, the Federal scientific expeditions in the various fields of mineralology, geology, botany, zoology, palaeontology, etc. This comprehensive bibliography will be arranged on the most modern lines and a number of valuable indexes will be attached, showing authors, institutions, geographical names, etc. In this first volume, some hundred pages are devoted to a bibliography of biography, beginning with JOHN ABBOT, the ornithologist to JOSEPH ZENTMAYER the maker of microscopes. (MAX NIESEL, *A Bibliography*, New York, 1925 ; price 5 dollars).

1025. **France : Promotion of Rural Engineering.** — The French *Académie d'Agriculture*, at its meeting of 13 February 1924, founded a biennial prize of 2000 francs, to be awarded to the French constructor or inventor who, during the five year period preceding the award of the prize, should bave made the most important improvement in the construction of an agricultural machine, the nature of which should be indicated in advance by the Academy. The prize

is to be awarded for the first time at the end of 1925, and will be given for the most important improvement made during the five years 1921-25 in the construction of a tractor plough, which can be also drawn by animals. The competition closes on 30 June 1925. (For particulars apply to the Academy, Rue de Bellechasse, Paris).

1026, **France: The Origin of Maize and the Production of New Varieties.**—On this subject two memoranda of M. BLARINGHEM have been presented by M. CONSTANTIN to the *Académie d'Agriculture* at its meeting of March 1925. Before the arrival of the Spaniards in America the Incas cultivated a large number of varieties of maize. M. CONSTANTIN has received some grains of *Euchlaena Mexicana*, which the natives regarded in accordance with an ancient tradition as the parent of maize. If transition from one genus to another is possible, it appears probable that the phenomenon may have been observed during the early history of Peru, by intelligent native observers. Señor BENTO DE TOLEDO, a Brazilian experimentor, has on his side obtained from a wild indigenous plant, referred to the genus *Euchlaena*, some plants very closely allied to those described by BLARINGHEM as degenerate maize. The study of dried material sent by BENTO TOLEDO has enabled Blaringhem to identify on the living specimen the characteristics of transition from a genus (*Euchlaena*) to another (*Zea*) by progressive metamorphosis.

1027. **France: Practical Classification of the Principal Varieties of Wheat cultivated in France and in French North Africa.** — The French Seed-Testing Committee had approved the synonymous classification of wheats by HENRY VILMORIN as the most practical. JACQUES VILMORIN has now constructed a dichotomous key for the rapid identification of wheat samples, retaining the general scheme of the fifty sections of the synonymous classification already mentioned and indicating besides whenever possible the botanical varieties recognised by Professor J. PERCIVAL (*The Wheat Plant, A Monograph*, London, 1922) and by Dr. N. I. VAVILOV (A contribution to the Classification of soft wheats, *Bulletin of Applied Botany and Plant-breeding*, Vol, XIII, No. 1, Leningrad, 1922-23).

The author has retained the division of all the cultivated varieties into seven main groups represented respectively by: *Triticum vulgare* Host; II. *Triticum turgidum* L.; III. *Triticum durum* Desf.; IV. *Triticum polonicum* L.; V. *Triticum spelta* L.; VI. *Triticum dicoccum* Schübler; VII. *Triticum monococcum* L. The other species appearing in the classification of Prof. PERCIVAL are assigned as follows: *T. compactum* (Host in the various groups of *T. vulgare*; *T. orientale* Perc. (with *T. polonicum*); *T. sphoerococcum* Perc. (with *T. vulgare*); *T. aegilopeides* Bal. (wild form of *T. mcnococcum*, and in its group); *T. diccocoides* Korn (wild form of *T. dicoccum* in the corresponding group; *pyramidale* Perc. (with *T. turgidum*). In addition *T. pergicum* Vav. is referred to *T. vulgare*.

The varieties cited by the author in his key are only quoted as examples. Naturally he cannot quote all the innumerable varieties already obtained and being obtained at the present time. As regards the North African wheats in particular, the authour has cited only a small number of forms, disregarding the work of BOEUF, DUCELLIER and MIEGE on the subject. (*Bulletin de l'Office de Renseignements agricoles*, No. 9, 1925).

1028. **France : Electrification of the Country Districts.** — M. R. PREAUD Chief Engineer of the Department of Rural Engineering in France concludes an article on this subject by pointing out that the characteristic difficulties arising in the distribution of electric power in the country districts lie in the fact that the rural networks require a maximum of installation expenses with à minimum of receipts. For the resolution of the important problem from the financial side and for the achievement of the solution of technical problems, there must be an active collaboration between the rural communities and the electrical firms, as also between the farmers, the communes, the departments and the State. This ideal of mutual support and co-operation is gradually gaining ground, was announced at the Bordeaux Congress (June 1922), was prominent at the Regional Congress at Montpellier (June 1923) and finally constituted the most important conclusion of the Lyons National Congress (October 1924). (R. PREAUD. L'électrification des campagnes. *Revue scientifique*. Special number published on the occasion of the White Coal Exhibition and Congress at Grenoble, Paris, 1925.

1028. **Tunis : Pig-breeding in Tunisia.** — This is successfully carried on in the centres of Tabarka, Tunis, Biserta, Deja and Souk-el-Arba. At Hamman-Lif a building has been put up for elaboration of pig products. The breeds of pigs to which attention is being given have been imported from Algeria, Malta and France and are reared on the local produce : potatoes, carrots, sugar beets, maize, barley, figs, acorns, sorghum, etc. (*Les Cahiers Coloniaux de l'Institut Colonial de Marseille*, No. 223, Toulouse, 1925).

1030. **Great Britain : Yeoman II Seed Wheat.** mention of which has already been made in this *Review* (Vol. III, 239, 1925), was distributed as arranged by the National Institute of Botany, Cambridge, the amount delivered of the new wheat being 2480 quarters. The price was fixed at £ 6.6.0 per quarter less 5 % discount for each. (*Journal of the Board of Agriculture*, Vol. XXXI, No. 11., 1069, London, 1925).

1031. **Sugar Beet from Field to Factory,** by R. N. DOWLING (formerly Agricultural Adviser to the National Sugar Beet Association). A concise and practical handbook written by one who has had a wide experience of sugar beet, both in England and on the Continent, and can envisage the matter from the farmers' point of view. *Contents* : Forword by Sir DANIEL HALL, K.C.B., F.R.S.; soils, rotation, cultivations, manuring, yield, implements, cost of production, sugar beet pulp or slices, diseases and pests, production of beet sugar. Pages 72, illustrations 8 ; price 2s. 6d. Publishers : ERNEST BENN Ltd., Bouverie Street, London, E. C.

1032. **Great Britain : Improved Incubators.**— A British electrical engineer, Mr. LEWELYN B. ATKINSON, is of opinion that in the ordinary incubators the eggs are heated too nearly alike on both sides, while under the sitting hen there is a difference of 14 to 20 degrees between the top of the egg which is in contact with the hen's body and the lower surface of the egg which is in contact with the floor of the nest. He has tried the experiment of putting a thin sheet of india-rubber over the eggs in the incubator. By this method in an incubator which has rarely given above 55 per cent. of the eggs placed in it, the percentage was raised to over 95 per cent. of the fertile eggs. Dr. M. A. JULI, poultry expert of the U. S. Department of Agriculture, says that the

ATKINSON experiments may have great significance for the American poultry business, which might draw an increased profit of several millions of dollars from the discovery. One of the most important factors of cost in the poultry business is the mortality of the chicks, and Dr. JULI is of opinion that the results of ATKINSON's experiments should be checked and tests made to determine their practical application. (*Science*, Vol. LXI, No. 1578, 1925).

1033. **Great Britain: The Manufacture of Synthetic Ammonia at Billingham.** — A guarantee of £2,000,000 has been made under the *Trade Facilities Act* as new capital for Synthetic Ammonia and Nitrates Ltd. The works at Billingham will be extended to four or five times their present size and the output, now 120 tons of ammonium sulphate daily, will then approach 800 tons a day. Great Britain is now by far the second largest producer of synthetic ammonia, Germany still coming first. The factory at Billingham has only been fully at work since the spring of 1924. The process used is a modification of the HABER process. (*Chemistry and Industry*, Year 44, No. 21, 1925).

1034. **A Commercial Atlas.** — A new Commercial Atlas on a large scale has been published by GEORGE PHILIP and SON and T. S. SHELDRAKE, under the auspices of the Association of British Chambers of Commerce (*Association of British Chambers of Commerce* and *The Trade and Engineering Supplement of "The Times"*). It is a monumental work which represents the achievement of a great scheme of practical utility and the result of immense labour. It is of large size, and contains 168 coloured maps, besides diagrams and explanatory text. This is the first time any publisher has attempted the immense task of preparing a complete survey, alike systematic and exact, of the economic resources and of the commercial and industrial activity of the whole world under the form of an atlas.

Of the five parts, the first contains maps and diagrams forming an introduction so to speak to the other parts: distances, mountain systems, principal markets of the world, exchanges, fairs, exhibitions, hydraulic power, electric power, meteorological maps, etc. The second part deals with communications and transport. The water ways of the world are shown in large double page maps, and there are various maps dealing with the different navigation companies. The third part includes detailed maps of the chief products of the world in their various commercial and industrial relation (cereals, forage crops, oil-yielding plants, textiles, etc. and also the different stock breeding industries, production of furs, skins, feathers, and finally the various mineral products of the world. The fourth part is devoted to the commercial development in its manifold aspects, of the different main regions of the world, and graphic representations are given by means of coloured maps of the reserves of animal, vegetable and mineral wealth. The last part is a commercial compendium of the various products including even the minor ones and the whole is concluded by an alphabetical index referring to the *Dual Classification of Commodities*. (*Chambers of Commerce Atlas*. George Philip and So Ltd. 32 Fleet Street).

1035. **Italy: The Nitrogen Problem.** — This problem has been the subject of special examination by the Technical Commission for the Improvement of Agriculture (*Commissione tecnica pel miglioramento dell'agricoltura*) which after a long debate passed a proposal of Prof. A. MENOZ, inviting the Govern-

ment to press forward the developement of the Italian nitrogen industry and to grant all facilities for the works which might be considered requisite.

The Commission also expressed the view that when the industry should need support in view of foreign competition, a premium, or bounty, of suitable proportions would be preferable to protective duties. (*La Terra*, Year 1, No. 6, Bologna, 1925).

1036. **Holland: Potash.** — In view of the decision of the Dutch Government to work the potash deposits at Winterswijk, near the German frontier, it is of interest to note that the president of the German Kalisyndikat has founded, in association with Dutch financiers, the N. V. Kaly-Syndicaat at Amsterdam, to prepare, sell and obtain potash and other fertilisers and mining products. The company which has a capital of 100,000 florins, owns land and works that previously belonged to the German Kalisyndikat. (*Chemistry and Industry*, Year 44, No. 15, London, 1925).

1037. **Pomology and Pomologists.** — In the annals of the Swedish Pomological Society for 1925 (*Sveriges Pomologiska Förenings Arsskrift*) M. CARLO G. DAHL publishes a historical monograph on pomology and pomologists, from Graeco-Roman times to the present day. The account is full of interesting information not generally known and there are a number of illustrations taken from old prints.

Journals and Reviews.

1038. **Austria: An Agricultural Market Gazette.** (*Oesterreichische Landwirtschaftliche Martkzeitung*). — In the first years of its existence the Lower Austrian Chamber of Agriculture (Vienna I, Stalburggasse 2) published every Thursday a market gazette, which was sent out to all the communes. These gazettes which were printed on a small sheet were intended to keep the farmers informed of the prices of grain, live stock, concentrated feeding stuffs, milk and sugar. They were put up in public places so as to be seen by everyone. They were of course concise and could not contain information on the general position of the markets, or news of the stock markets. From 1 January 1925 the Lower Austrian Chamber of Agriculture has published the *Oesterreichische Landwirtschaftliche Martkzeitung*, which contains the following parts: a leading article dealing with important questions in relation to the agricultural markets; shorter articles on the same subjects, practical advice on the purchase of various requisites, comparisons between the composition of materials placed on the market and their prices, notes on admixtures, adulterations, new legislative measures, results of statistical enquiries, etc. The daily market lists of the various Austrian markets are added in the form of tables and notes on the general position of these markets.

Particulars of the forthcoming cattle markets follow, and the gazette also makes a special announcement of the information which the farmers send in for insertion as to purchase or sale of a given material or product. The most important information on prices and position of markets are reprinted subsequently on a special sheet, so as to be conveniently posted up for the use of the whole community. The Market Gazette is published by the Lower Austrian Chamber of Agriculture with the support of the agricultural corporations of the

various centres. The editor is RUDOLF KLEIN, inspector of the Chamber of Agriculture. The Gazette appears weekly, price 4 schellings a year for Austria (1 schelling = 10,000 Austrian crowns) ; 35 Czecho-slovakian crowns, or four and a half marks for Germany.

1039. **Austria : The "Landwirt".** — The Lower Austrian Chamber of Agriculture, which came into being by the law of 22 February 1922 had published "Mitteilungen" at irregular intervals. The periodical had no great circulation and contained merely brief official communications or mention of important measures. From 15 January of this year the *Landwirt* has been coming out in the middle of each month, as a quarto publication of 36 to 48 pages, and serving as the special organ of the Chamber of Agriculture. It contains the official communications already mentioned, reports of various agricultural and viticultural societies, which do not publish their own periodical and in addition special articles on agricultural policy, taxes, arboriculture, fruit-growing, viticulture and wine making, protection of plants, stock-breeding, cultivation of alpine pastures, etc. A short review of current events accompanies every special heading, each of which is carefully edited by the reporters of the Chamber of Agriculture. There is a section also for replies to requests for information.

The concluding article of each number of the *Landwirt* is informative and a given subject is explained in the clearest possible manner : e. g. in No. 1 the value of fertilising ; in Nos. 2 and 3, insects useful to farmers, etc. The editor is the Government Advisor JOSEF LOSCHNIG, and the paper is published by the Lower Austrian Chamber of Agriculture, Vienna I, Stallburggasse 2. In the interest of the encouragement of agriculture, the price is very low : it is two and a half schellings yearly for those farmers who are electors of the Chamber of Agriculture and five schellings for the members of societies which work in cooperation with the Chamber.

1040. **Austria : The Vienna Centralblatt für das gesamte Forstwesen.** — This paper has completed its quincentenary. The first number appeared in 1 January 1875 owing to the activity of the veteran teacher ROBERT MICKLITZ, then Chief of the Austrian Forestry Administration. He was ably supported at that time by Prof. G. HEMPEL, and both workers had the valuable assistance of the firm of publishers FAESY and FRICK (now the FRICK Company) In 1983 the editorship was assumed by Prof. v. SECKENDORFF and from that time the periodical became the organ of the Mariabrunn Forestry Experiment Station (Forstliche Versuchsanstalt). When at a later date the work of editing was undertaken in part by Prof. CIESLAR, the review became merely the official organ of the Chairs of Forestry at the Vienna Higher School of Agriculture.

1041. **A New Brazilian Agricultural Review.** — The first number of this Review, which appears monthly under the title of *Ceres*, was published in São Paulo last May. It is above all a periodical of propaganda and agricultural measures. Dr. CARVALHO BARBOSA and Dr. ROGERIO DE CAMARGO are the technical directors. The first number contains a report on the agricultural experiments carried out in the country for the farmers of São Simão, in 1923 and 1924, with the wheat of "Monte Claros", variety native to Minas Geraes, grown in the municipality of Monte Claros, from which it takes its name.

1042. **A New French Review on Present Day Problems in Agriculture.** — Entitled *Les Fastes de l'Agriculture* (The agricultural Calendars) and directed by Ing. Agr. J. H. RICARD. Its object is to present every year a complete picture of the agricultural events of the past year and to explain the principal questions of present day agriculture The number for 1925 contains articles on the different branches of rural production and on important national and international questions (fiscal, customs, etc.) which are of interest to agriculturists. It contains numerous illustrations and graphs. The Review costs 4.50 frs. a number.

1043. **The Paris Scientific Review.** — On the occasion of the Congress and the Exhibition of white coal at Grenoble (May to November 1925), was published a special number entirely devoted to the various aspects of specially applied hydraulic energy. The number, well illustrated, contains an introduction by A. RATEAU, member of the Academy of Science, and a chapter on the Grenoble Exhibition, edited by Ing. A. BLOCH. There follow various chapters of a general order : on the causes of energy (Prof. A. FOCH), on the financial problem of fossil coal (G. TOCHON) on the regulations of hydraulic forces (Ing. J. DUPIN), and a retrospective glance at the hydrodynamic studies in France (Prof. JOGUET). Lastly, there follow the chapter on applied technology : hydraulic turbines (Ing. D. EYDOUX), the electrification of the country (Ing. R. PREAUD), the electrification of the railways of Southern France (Eng. MASSONNEAU), the distribution of electric energy (MONMERGUE), electricity and the electrification of the railways (H. PARODI).

1044. **English Avicultural Annual.** — The Annual for 1925, published by the English journal *The Feathered World*, forms this year a fine illustrated volume (*The Feathered World Year Book*), of interest to all classes of aviculturists. Price $^3/_6$. For particulars apply to the Editor of the above-named journal, 9, Arundel Street, Strand, London, W.C. 2.

1045. **Holland : Il Nederlandsch Weekblad voor Zuivelbereiding en Handel** (Dutch weekly periodical for the cheese industry and commerce), organ of the Dutch producers and merchants of milk foods, has published a Jubilee number (Year 31, No. 6, 12 May 1925) on its 30th anniversary. An article by Prof. Dr. H. M. KROON contains recollections on the foundation of the periodical, and in another article there are short accounts with portraits of persons who have taken the lead in the science and practice of cheese making : Prof. B. VAN DER BURG of the Higher School of Agriculture in Wageningen ; Prof. F. W. I. BOEKHOUT, Director of the Bacteriological Section of the Government Agricultural Experiment Station of Hoord ; Prof. E. HEKMA, Director of the Physiological Section, also of the Hoorn Station ; Prof. W. KEESTRA, Director of the Government School of cheese-making in Bolsward, and of consulting cheese experts J. J. C. AMENT, Eng. P. N. BOEKEL, Dr. A. G. BREEN, H. B. HYLKEMA, Eng. A. K. HYLKEMA, J. J. HUISMAN, Ing. W. J. HUISMAN, Dr. L. T. C. SCHEY, J. J. WINTERMANS, Eng. W. R. ZUIDEMA, C. ZWAGERMAN.

1046. **Annual of the Swedish Pomological Society.** — Mr. EMILE JOHANNSON has drawn up a useful general index of this annual (*Sveriges Pomologiska Förenings Arsskrift*) for the years I-XXV (1900-1924) divided

according to subjects. It is published in the two first quarterly numbers of the 1925 issue of the same Review.

Personal.

1047. ARISTIDES AGRAMONTE, professor of Bacteriology at the University of Havannah and delegate of Cuba at the Third Pan-American Scientific Congress, was given an honorary degree in science by the University of San Marcos, Lima, Peru and was also nominated corresponding member of the Peruvian Medical Academy.

1048. The Maine (United States) Federation of Agricultural Associations will offer the University of that State a bronze plaque to the memory of RUTILLUS ALDEN to whom the progress of agriculture in Maine owes much.

1049. The Royal Horticultural Society, London, has awarded the LINDLEY Gold Medal to ALBERT C. BURRAGE of Boston, president of the Massachusetts Horticultural Society and of the American Orchid Society, for his show of New England plants at the Chelsea exhibition.

1050. THOMAS L. CASEY, retired colonel of the American army, who died some months ago at Washington, D.C., has left his collection of coleoptera and his library of entomological works as well as malariological collection and library to the National Museum of the United States. The collection of coleoptera contains 15,000 species, about a third being typical.

1051. The American Association for the advancement of Science has granted a reward of 500 dollars to Dr. L. E. CLEVELAND of the Johns Hopkins School of Hygiene and Public Health, for one of his works on the physiology of white ants and their parasites.

1052. A celebration took place of the 60th birthday of Dr. MAX CREMER, professor of physiology at the Veterinary Institute of Berlin University. The *Biochemische Zeitschrift* dedicated a special number to CREMER on that occasion.

1053. An "Institute of Radium" will be founded by national subscription in honour of Madame CURIE at Warsaw (Poland), birth-place of that great scientist.

1054. Dr. MARTIN H. FISCHER of Cincinnati University was elected corresponding member of the Czecho-Slovakian Botanical Society for his services to botanical Science.

1055. Dr. KURT GOTTLOB, noted for his technico-scientific works on rubber, died in Lower Austria on the 23rd of April 1925.

1056. Professor BATTISTA GRASSI died in Rome on March 4th 1925, aged 71. The life of the illustrious biologist was one of continual devotion to scientific research and many of his discoveries will remain classic owing to their fruitful application in the clinic and in the field of agriculture. In his early years, after having graduated in medicine and surgery (1878), he published his first researches on *anguillula intestinalis*, on *Ascaris lumbricoides*, on *Ascaris mystax*, on *Oxyurus* and on *Trichocephalus*. At the age of 29 he was elected professor of Zoology at the University of Catania (1883), and he rose to great fame through his studies on termites as well as for other valuable work. Called to Rome in 1895, he conducted and concluded his successful and well known researches in malariology (in collaboration with BIGNAMI and BASTIANELLI) which led him

to identify the Anopheles as transmitting agents of human malaria. As a result of these researches he had already forestalled ROSS in the discovery of the *Proteosoma precox*, the parasite of malaria of birds.

His works on phlebotomy and goitre proved fruitful on the scientific side. No less fame came to GRASSI for the admirable investigations he undertook or caused to be ŭndertaken in his laboratory by diligent collaborators (FOÀ, GRANDORI, BONFIGLI, TOPI) on phylloxera, which were collected in 1912 in a large volume of over 450 pages, with 19 plates, a work which BORNER called monumental and which was mainly the results of his researches on the phylloxera of vines.

The various branches of zoology treated by this celebrated investigator, were handled with remarkable breadth of view. GRASSI was a distinguished member of 24 foreign and of all the principal Italian Societies and Academies. His discoveries gained him the DARWIN medal of the *Royal Society*; the MARY KINGSLEY medal of the Liverpool *School* of *Tropical Medicine;* the Paris award of the Madrid International Congress of Medicine; the VALLAURI award of the Torino Academy; the BALBI award of the Lombardo Veneto Institute; the royal award of the Academy of the Lincei; the Beckeepers' Gold Medal; the Italian agriculturists Gold Crown. (In honour of BATTISTA GRASSI. Publication issued by the Committee of the "*Fondazione per gli studi zoologici delle malattie parassitarie*"; 1 Vol., 8°; pp. 108, published, Rome, 1925. (C. COTRONEI. *Battista Grassi.* Abstract from the *Monitore Zoologico Italiano*, Year XXXVI, n. 4-5, Siena, 1925).

1057. Professor ALBIN HALLER, director of the Institute of Physics and Chemistry of the Sorbonne, died on the 1st of March last, at the age of 76. He was renowned for his numerous works on camphor and bye-products, on anthracene and bye-products, menthol, organic acids, fats, waxes, etc.

1058. The T. KOCHER award of Berne University was conferred on Professor BALTZER to enable him to continue his researches on heredity and on sex predetermination.

1059. The Confidential Government Counsellor, Professor Dr. PAOLO KULISCH, well known for his studies in enology and Director of the Higher School of Agriculture and Brewery in Weihenstephan, on April 1 1925, completed 40 years of practical-scientific activity. In 1910 he was nominated Director of the Agricultral Experiment Station of Colmar in Alsatia, and was expelled in December 1918. In May 1921 he was chosen to occupy the position of Director of the School of Weihenstephan.

1060. The well-known viticulturist E. MAROGER, member of the Agricultural Office of the South, of the Council of Administration of the National School of Agriculture of Montpellier, etc. died in France. His experiments on the cultivation of vineyards are noteworthy. The last number of the present Review has just published one of his articles on this subject. A few days before his death he was invited by the Argentine Government to the conferences on viticulture.

1061. Dr. G. MARQUARD, Professor of Chemistry and Biology at the Maria Theresa Royal School of Munich, celebrated his 70th birthday.

1062. The death is announced at the age of 56, of Forestry Engineer UGO SZALTNA, Professor of the Higher School of Agriculture of Prague.

1063. The Privy Counsellor of Commerce, G. VON SEDLMAYR of Munich Director of the Scientific Station for the Brewing Industry, celebrated his 75 birthday on 5 April 1925.

1064. French Agriculture has lost one of her most active and best known members by the death of Viscount JULES FAYDIT DE TERSSAC, member of the *Conseil Supérieur d'Agriculture* since 1905 and president of numerous agricultural and stock breeding societies.

1065. KWOK WAH SHAU of the Chinese province of Haungshan, died on 14 July 1925. He is well known for his horticultural studies, particularly of lemons. With regard to the latter, he completed exhaustive investigations with GROFF in the research of varieties resistant to canker, for the *Ling Nan Agricultural College* of Canton. The college has lost one of its best students in KWOK and will publish a full biography in a future number of the *Linganam Agricultural Review*. The *Agricultural Monthly* has already published an obituary notice, in Chinese.

Dott. G. A .R. BORGHESANI, *direttore responsabile.*

INTERNATIONAL REVIEW

OF THE

SCIENCE AND PRACTICE

OF

AGRICULTURE

PUBLISHED BY THE INTERNATIONAL INSTITUTE OF AGRICULTURE

New Series 1925 Vol. III.

INDEX

ROME

PRINTING OFFICE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

—

1926

CONTENTS

FOREWORD . . . . Page 5

I. — Index of Original Articles . . . . » 7

II. — Index of the Proceedings of the International Society of Soil Science and of the International Seed Testing Association . . . . » 8

III. — Index of special activities of the Bureau of Agricultural Science of the International Institute of Agriculture . . . . » 9

IV. — Index of Agricultural Intelligence:

A) Subjects . . . . » 11

B) Authors . . . . » 71

V. — Index of Plant Diseases:

A) Subjects . . . . » 81

B) Authors . . . . » 91

FOREWORD

The index arranged alphabetically is divided into five sections: 1) original articles; 2) proceedings of the International Society of Soil Science and of the International Seed Testing Association; 3) special activities of the Bureau of Agricultural Science of the International Institute of Agriculture; 4) agricultural intelligence; 5) plant diseases.

These two last sections are divided into two parts:— *a*) subject matter; *b*) authors; they contain both the references of the first three sections and of the current notices.

Under generic headings only information of a general character is given; information on special subjects is given under that special heading.

The four first sections have been compiled by Dr. Francesca Dorio, those on plant diseases by Professor Giulio Trinchieri.

I. — ORIGINAL ARTICLES

BORDIGA, O., State Irrigation, and Agriculture in the South of Italy . . . . *Page* 694
BRANCOVICI, E., State of the Cereal Crops and Trade in Roumania . . . . » 1004
BUTLER, E. J., Meteorological Conditions and Plant Diseases . » 369
CHEVALIER, A., A Bio-Geographical Classification of the Principal Cropping Systems of the World . . . . » 663
CHIRITESCU-ARVA, M., The Cultivation of Leguminous Seed Crops in Roumania . . . . » 680
CONSTANTINESCO, G. K., The Domestic Animals of Roumania . » 972
DIAZ-OSSA, B., The Chilean Nitrate Industry . . . . » 942
GORINI, C., Mammary Microflora in Relation to Cheesemaking » 65
KINZEL, W., The Beneficial and Injurious Effects of Short-wave Rays in Nature. » 331
KUCHARENKO, J. A.,, New Theory of Solutions . . . . » 1
KUCHARENKO, J. A.,, The Propagation of Crystals in a Supersaturated solution . . . . » 651
MARCHAL, E., The Phytopathological Problem in Belgium . . » 88
MARCQ, J., The Nutritive Value of Phosphorous in Cattle Feeds » 58
MARKOFF, L., Vine-growing and Wine Production in Russia before the Great War and at Present. . . . . » 17
MARKOFF, L., The Vine-growing Districts of Russia . . . . . . » 357
MAROGER, R., Two Experiments in Vine-training in Lower Languedoc, France . . . . » 350
MONTEMARTINI, L., The Electrogenetic Laboratory at Belgirate and the Methods proposed by Alberto Pirovano . . . . . » 10
MUNTEANU, A., The cultivation of Wheat and other Cereals in Roumania . . . . » 338
PORCHEREL, A., Heredity in the Mule. . . . . » 982
STOKLASA, J., Aluminium in Organic Life . . . . » 655
STOKLASA, J., The Physiological Value of Phosphoric Acid in Superphosphate and other Phosphates. . . . . » 921
STOKLASA, J. and PENKAWA, J., The Radioactivity of the Eruptive Gases of Vesuvius and other Solfatara Volcanoes, and their Influence on the Development of Bacteria and of Higher Vegetation . . . . » 327
TEODORESCU, I. C., Vine-growing in Roumania . . . . » 35
VAN RIJN, I. J. L., Agriculture in Holland . . . . » 385

II. — INTERNATIONAL ASSOCIATIONS

PROCEEDINGS OF THE INTERNATIONAL SOCIETY OF SOIL SCIENCE.

Papers.

AARNIO, B., Brown Earth in Finland	*Page*	40
ARRHENIUS, O., The Influence of Neutral Salts on Soil Reaction	»	123
AVATTANEO, R., The Degree of Solubility of Phosphate and Potash Fertilisers necessary to maintain the Soil Solution at the Concentration required by Plants	»	725
FROSTERUS, B. and FRAUENFELDER, H., Apparatus for Soil Volume Determination	»	100
HISSINK, D. J., Methods of Mechanical Analysis of Soils . . .	»	705
NIKLAS, H. and VOGEL, F., To what Extent is the Lime Content and Reaction of a Soil related to the Manner of its Formation	»	1018
SMOLÍK, L., Hydrogen-Peroxide Catalase of Marsh Soils. . . .	»	105
SPIRHANZL, F., The Help of Graphs in Kopecký's Scale for Soil Classification by Mechanical Analysis	»	121
TRÉNEL, M., On the question of KCl Addition in the Case of the Electrometric Determination of the Soil Reaction. II: Can Lime-requirements of the Soil be determined from the Reaction of Soil-suspensions containing Potassium Chloride?	»	1011
VILENSKY, D., Classification of Soils on the Basis of Analogous Series in Soil Formation	»	1036
Abstracts and Literature	»	133-166
	»	409-453
	»	728-759
		1054-1089

General Notices.

The "International Reports on Soil Science"	*Page*	166
The International Society of Soil Science	»	166,759
	»	1090
Rules of the International Society of Soil Science	»	454
Committees	»	457-467
	»	760-763
Request for Co-operation in International Comparative Analyses by preparation of the Soil Samples for Mechanical Analysis	»	460
Circular of the II International Committee for the Study of Soil Chemistry on the Question of the Preparation of Hydrochloric Acid Soil Extracts	»	463
Appeal for Co-operation in the Work of the VI Commission on		

the Application of Soil Science to Scientific Agriculture . . Page 1092
Report of the Work of the Committee for the Agro-geological Map of Europe, 1924. » 466
Report of a Meeting of the Supervisory Committee for the International Soil Map of Europe on 8th and 9th May 1925, in Berlin . . . . » 762
Notice of May 1925 . . . . » 760
Proceedings for 1926 . . . . » 1094
Brief statement concerning Progress made in the Organisation of the I International Congress in Soil Science . . . . . . » 1090
Journal " Pedologie " . . . . » 763
Personal . . . . » 763

PROCEEDINGS OF THE INTERNATIONAL SEED TESTING ASSOCIATION

Papers.

FRANÇOIS, L., The Place of Origin of Seeds . . . . Page 1134
GENTNER, G., Contribution to a Monograph on the Determination of the Country of Origin of Clover and Forage Crop Seed . . » 1095
VON PETERY, W., Investigation in regard to Weed Seeds found among the Seeds of Argentina, with reference to their Origin and Distribution in the producing Districts of Argentina . . » 1163
Abstracts and Literature . . . . » 1173

General Information.

Members of the International Seed Testing Association . . . Page 1177

III. — SPECIAL ACTIVITIES OF THE BUREAU OF AGRICULTURAL SCIENCE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

INTERNATIONAL COMMISSION OF AGRICULTURAL METEOROLOGY.

International Institute of Agricultural Ecology . . . . Page 766

ENQUIRY ON TESTING OF DAIRY COWS.

New Annual Enquiry . . . . » 485
SMITH, W., The Development of the Dairy Industry in India . » 781

ENQUIRY ON THE PREVENTION OF ANTHRAX INFECTION OF HERDS.

Report . . . . Page 788

ENQUIRY ON THE STOCK BREEDING SERVICES AND HIGHER INSTRUCTION IN STOCK BREEDING.

The First Results . . . . Page 788

ENQUIRY AS TO THE RESULTS OBTAINED BY FARM ACCOUNTANCY.

New Enquiry . . . . Page 789

ENQUIRY ON LOCUST CONTROL.

JABLONOWSKI, J., Locusts in Hungary during 1924 . . . . . Page 468
KINCH, E. A., Locusts in Iraq . . . . » 1182
Locusts in the Colony of Eritrea . . . . » 483
Locusts in Italian Somaliland . . . . » 483
Locusts in Egypt . . . . » 484
Locusts in Cirenaica . . . . » 787
Locusts in Tripoli . . . . » 788
International Organisation for Locust Control . . . . » 1189

ENQUIRY ON THE OLIVE FLY.

Control of the Olive Fly in Turkey . . . . Page 484

IV. — AGRICULTURAL INTELLIGENCE

A) INDEX OF SUBJECTS

ABERIA CAFFRA, 76.

Abortion (bacterial): in cows, *p.* 69, *p.* 72. – Influence of epizootic abortion on milk and butter production, 343.

Abutilon tortuosum, 636.

Acalypha virginica, *p.* 1103, *p.* 1120.

Achillea ptarmica, *p.* 1100.

Acroptilon Picris, *p.* 1140.

Aegilops: Hybrids from wheat and *Ae.*, 297.

Aeroplane: used for distribution of insecticides in America, 820. – Aerial Map of Forests of the Irrawaddy Delta, 243.

Aeta (*Mauritia flexuosa*), 635. – See also Ite.

Agave sisalana, 313, 584, 585, 842.

Agriculture: conditions and development in different countries: *Algeria*: colonisation, 656. – *Austria* Reafforestation in Lower A., 1010. – *Belgian Congo*: Evolution of Botanical Agronomical Formations in Western Congo, 19. – *Brazil*: Agricultural development, 226, 1011. – – Official data on a. d., 743. – Agricultural problems, 496. – Report on agricultural progress, 756. – New agricultural and zootechnical Services, 445. – Coffee planting in São Paulo, 1012; in Paraná, 1013. – Cotton growing, 497. – *British India*: Cultivation of improved varieties of Crops, 1015. – *British West Africa*: Oil-palm industry, 1017. – *British West Indies*: Report of the Agricultural department of St. Vincent, 449. – *China*: Camphor planting, 1014. – *Colombia*: Committee on social welfare and agriculture, 178. – National reserves for a., 227. – *Czechoslovakia*: Note on a., 750. – Improvement of Pasture lands, 1019. – *Federated Malay States*: Work of the Department of A., 184. – *French West Indies*: Encouragement of various plantations in Martinique, 658. – *Germany*: Situation of German a., 742. – Soil cultivation and national farming, *p.* 156. – *Great Britain*: Annual agricultural returns, 399. – *Haiti*: Official Agricultural institutions, 165. – Manual on a., for the lower Schools, 166. – *Indo-China*: Rubber planting in Cochin-China, 228. – *Italy*: Agricultural production, 230. – Home Colonisation, 500, 764. – Competition in a., 690. – Decrees on land improvement and agricultural credits, 660, 706, 763. – Foundation for Study of feeding dairy cows, 691. – *Java*: Soil types *p.* 164. – *Luxemburg*: Chamber of a., 403. – *Morocco*: Decree for agricultural and silk industries, 657. – *Netherlands*: Agricultural production, *p.* 385. – *Palestine*: Agricultural conditions, *p.* 751. – *Panama*: Land Settle-

ment, 231. – *Poland* : Report on plant and animal production, 711. – *Portugal* : Re-organisation of Ministry of a., 405. – Utilisation of Waste Lands, 406. – *Roumania* : Agrarian policy and production, 501. – Development of a., as a result of agricultural reforms, 1018. – *Russia* : Agricultural progress, 749. - Soil Structure, *p.* 160. Requirements in agricultural machinery, 502. – *Salvador* : Measures for encouragement of a., 150. – *Serbia* : Seed selection and viticulture, 151. – *Spain* : Organisation of agricultural and zootechnical services, 389. – *Straits Settlements* : Work of Department of a., 184. – *Sumatra* : Soil types, *p.* 164. – *Tripoli* : Regulation of agricultural services, 187. – *Union of South Africa* : Cotton growing in Nyasaland, 1016. – *United States* : Inspection Division established, 144. – Community Cotton production, 498. – Missouri Year Book on a., 779. – *Uruguay* : Agricultural progress, 232.

Agricultural Methods and Land Reclamation : Bio-geographical classification of principal cropping systems of the World, *p.* 663. – Subsoil dynamiting experiments, *p.* 731. – Drought investigations at Bari agricultural experiment Station, Apulia, 935. – Experiments with fallow, 619. – Subsoiling trials, 618. – Spacing experiments, 620, 880. – Spaced-row and hoeing system in wheat cultivation, 616. – Mechanical tillage on sugar plantations, 617. – Orchard practices in S. Californian Citrus industry, 594.

Agricultural and Scientific Institutions and Associations : International : *Belgium* : Int. Federation of Aviculture, Brussels, 694. – *France* : Int. Bureau of Epizootics, Paris, 177. – *Great Britain* : Empire Cotton growing Corporation, 183. – Int. Society for the History of Science, 447. – *Holland* : Internat Committee of Phytopathology and Economic Entomology, 440. – *Italy* : Int. network of stations of Agric. Ecology, *p.* 778. – Int. Society of Soil Science : General information, *p.* 166, *p.* 454, *p.* 759, *p.* 1090. – Internat. Soil Science Commissions, *p.* 760. – Int. Commission for Study of Soil chemistry, *p.* 761. – Meeting of Supervisory Committee for Int. Soil Map of Europe. (Berlin), May 1925, *p.* 762. – Notices, *p.* 760. Inter. Seed testing Assoc., Papers, *p.* 1095, *p.* 1134, *p.* 1163 ; Abstracts, *p.* 1173 ; General information, *p.* 1177. – *Switzerland* : League of Nations Anti-Opium Campaign, 752. – L. of N., and foundation of Singapore Office of Epidemiology, 941. – *United States* : Inter. Inst. of Co-operation, 441. – National : *Algeria* : " Union Ovine de l'Afrique du Nord ", 875. – Poultry Breeding Society, 182. – *Austria* : Viennese Agriculture and Forestry Club, 695. – State activity in Lower A., on Land improvement, 443. – *Australia* : Western Australian Forestry report, 710. – *Belgium* : Belgian Peasant's Union, 942. – *Brazil* : Permanent Government Agr. information service, 944. – Government seeds and cotton services, 943. – São Simão Seed Farm, 444. – New Agr. and Zootechnical services, 445. – *British India* : Indian Central Cotton Committee, 930. – *British West Indies* : St. Vincent agr. department, 449. – *Canada* : Dominion Water-power and Reclamation service, 947. – *Colombia* : Committee on Social

Welfare and Agriculture, 178. – Agr. Assoc. of C., 696. – *Cuba*: Nat. Assoc. of Horticulture, 700. – *Czechoslovakia*: Horse-breeding stations, 949. – *Equador*: Agr. and Stock-breeding services, 697. – *Federated Malay States*: Department of Agriculture, 184. – Singapore Office of Epidemiology, 941. – *France*: Congress at Grenoble of the "Assoc. française pour l'avancement des Sciences", 717. – "Colonies-Sciences" Assoc., 945. – "Comité Central de Culture mécanique", 701. – National bureau of combustible liquids, 701. – *Germany*: "Deutsche Landw. Gesellschaft", Exhibition at Stuttgart, 1925, 990. – Bavarian bureau for sale of materials for increasing crop yields, 442. – *Great Britain*: British Committee of Agr. Meteorology, 448. – Apple packing stations, 946. – *Indo-China*: Annam veterinary service, 704. – *Italy*: Proceedings of the "Società Agronomica Italiana", 708. – Inst. of Agr. Economics and Statistics, 185. – Nat. Research Council, 450. – Nat. Assoc. of Agr. Press, 451. – Federation "Pro-Montibus", 707. – "Parco nazionale d'Abruzzo", 948. – *Japan*: Gifts for Japanese libraries destroyed by earthquake, 188. – *Isle of Reunion*: Water and Forestry Service, 703. – *Roumania*: Departmental agr. Chambers, 892. – *Russia*: Organisation of cold storage, 190. – Technical chemical bureau of Sugar-refining Union, Kiev, 452. – Ukraine Committee for Scientific Agriculture, 453. – *Sweden*: Swedish Pomological Society, 1046. – *Tripoli*: Regulation of Agr. services, 187. – *Union of South Africa*: Report of Department of Agriculture, 705. – Drought Commission, 709. – *United States*: Development of Federal Crop Reporting service, 698. – American Assoc. for advancement of Science, 699. – Parasitological Society, 446. – See also: Agricultural Instruction and Experiments.

Agropyrum repens, *p.* 1098, *p.* 1104, *p.* 1105.

Agrostemma Githago, *p.* 1169, *p.* 1170.

Ailanthus fauveliana, *A. malabarica*, 852.

Albania: American-Albanian College of Agriculture and Trade, 181.

Alcohol: see Distilleries.

Alfalfa: see Forage crops, Lucerne.

Algae: as manure, 274; as Cattle fodder, 865. – Extraction of Potash from a., 12.

Algeria: Colonisation, 656. – Classification of principal varieties of wheat cultivated in A., 1027. – Impurities in Barley seeds from A., *p.* 1138, *p.* 1139. – Asses and mares for mule breeding, *p.* 984. – Regulations re importation of plants into A., 398. – Poultry keeping in A., 182. – re Congress of Wheat growers in A., 718.

Alkaloids in Quinine, discovery of, 770.

Allium Porrum, *p.* 333.

Almond: Varieties grown in U. S. A., 596.

Alnus glutinosa, *p.* 1078.

Althaea rosea: ionolysis, *p.* 13.

Altingia excelsa: Resin of Indo-china, 852.

Aluminium in Organic Life, *p.* 655.

Amaranthus sp., *p.* 1119. – *A. albus*, *p.* 1102, *p.* 1117; 577. – *A. blitoides*, *p.* 1103. – *A. chlorostachys*, *p.* 1166, *p.* 1168, *p.* 1169. – *A. retroflexus*, *p.* 1102, *p.* 1117.

Ambrosia artemisiaefolia: *p.* 1103, *p.* 1119, *p.* 1140. – *A. tenuifolia*, *p.* 1167.

Ammi Visnaga, *p.* 1169.

Amomum Granum-Paradisi, 636.

Amorpha, *p*. 331.
Anacardium occidentale : see Cashew nut oil, 110.
Anagallis arvensis, *p*. 1115, *p*. 1130.
Analysis of Fertilisers : report on standardisation of methods of A. of F., 711. – A. of seeds, 711; *p*. 1173, *p*. 1174. – A. of soils, see Soil Science.
Andropogon Ischaemon, *p*. 1103.
Anisoptera cochinchinensis, *A. glabra*, *A. robusta*, 852.
Annals of Swedish Pomological Society, 1046. – A. of English Aviculture, (English Avicultural Annual), 1044.
Anthemis arvensis, *p*. 1104, *p*. 1130. – *A Cotula*, *p*. 1169. – *A. ruthenica*, *p*. 1101.
Antherea Pernyi, 798.
Anthoxanthum odoratum, 578.
Anthyllis Vulneraria, *p*. 1098, *p*. 1099.
Ants : influence on pollination in a Cacao plantation, 565.
Apiculture : in Austria : order in regard to diseases of Bees, 384. – in Poland, 99. – International Exhibition at Lyons, 1925, 210. – "La Colmena" (the Bee-Hive), Spanish periodical, 775.
Apple : Germination capacity of pollen in different varieties, 300. – Floral biology, 858. – Harvesting and Storage, 117, 631. – Loss in weight of stored a., 118. – Packing stations in G. Britain, 946. – Overseas transport problems, 632. – Hygienic conditions in Belgium, *p*. 92.
Apprenticeship in agriculture : organisation advocated at International Congress of Agriculture, Warsaw, 21-24 June 1925, 711.
Apricot-tree : hygienic conditions of a. t. in Belgium, *p*. 93.
Argemone mexicana, *p*. 1169.
Argentine : Origin and distribution of weed seeds of A., *p*. 1163. – Measures of control against Cotton parasites, 140. – International Congress of Social Economy, Buenos Aires, 1924, 712.
Atriplex hastatum, *p*. 1115, *p*. 1117. *A. pamparum*, *p*. 1116. – *A. patulum*, *p*. 1115, *p*. 1117.
Arrowroot refuse in paper-making, 636.
Arsenic : Toxicity of locusts poisoned by a., and given as fodder to livestock, 85.
Artemisia, *p*. 162.
Artificial Drying : of Sweet corn, 120 ; of hay and corn crops, 104.
Ass : in mule-breeding, *p*. 982.
Associations and Institutions : see Agricultural and Scientific Institutions and Associations.
Asteriscus spinosus, *p*. 1153.
Astrocaryon Tucuman, 755.
Attalea compta, *A. excelsa*, 755. – *A. funifera*, 755, 850. – *A. speciosa*, 850. – *A. spectabilis*, 755.
Australia : Flora and Fauna of S. Australia, 513. – Dawson Valley irrigation scheme, Queensland, 747. – New wheat varieties in Queensland, 830. – Impurities in barley, *p*. 1138. – Seed maize improvement in Queensland, 41. – Potato production under irrigation in Victoria, 50. – Cotton in Queensland, 582. Improvement of Queensland cotton seed, 845. – Cotton grading in Queensland, 844. – Experiments on Sugar Cane, Soils, etc., in Queensland, 70. – Sugar cane cultivation in Queensland, 71. – "Huon pine" essence from Tasmania, 593. – West Australian Forestry report, 710. – "Coolibah" timber from W. Australia, 602. – Australian Agricultural Research Institute, Adelaide, 687. – Camberra, N. S. W. National Museum for Study of Australian Fauna, 684.

Austria : Land-reclamation and improvement in Lower A., 443. – Chemical fertilisers in A. since the War, 281. – Cultivation of Wheat by spaced-row and hoeing system, 616. – Experiments in acclimatising Scotch potatoes, 307. – Re-afforestation in Lower A., 1010. – Light Horse breeding, 991. – Introduction of milking machine, 351. – Laying competition at Klosterneuburg, 348. – Home brandy distilling in Lower A., 353. – *Laws* : re Trade in seeds, 380. – re encouragement of Horse breeding in Lower A., 383. – re Bee diseases, 384 – re pests and diseases of plants, 381, 382. – re protection of natural features of Lower A., 385. – *Agricultural instruction and experiments* : Recent developments of Agricultural education in Lower A. 408. – Demonstration Farms, Vienna Higher School of Agriculture, 409. – Experimental Station of Agricultural Chemistry, Immst, Tyrol, 155. – Experimental Forestry Institute, Giessen, 407. – 50th Anniversary of Experimental Forestry Institute of Mariabrunn, 896. – *Agricultural Clubs* : Viennese Agricultural and Forestry Club, 695. – *Fairs* : Vienna, 992. – Alpine Agricultural Fair, Innsbruck, 1924, 214. – Agricultural periodicals: *Biologia generalis*, 252. – *Der Landwirt*, 1039. – *Centralblatt für das gesamte Forstwesen*, 1040. – *Internationale Holzzeitung* 253. – *Oesterreichische landw. Marktzeitung*, 1038.

Avena fatua, *p.* 1169, *p.* 1170. – *A. hybrida*, *p.* 1170. – *A. sativa*, see Oats.

Azotobacter : Investigations re, *p.* 432.

BABASSÙ (*Attalea speciosa ; Orbignia Martiana*) in Brazil, 226, 755, 850, 1020.

" Bacaba " (*Oenocarpus distichus*), 755.

Bacteriology (Agricultural) : see Soil Science.

" Balata " (*Mimusops bidentata*), 226.

Ballota nigra, *p.* 1100, *p.* 1117.

" Balsa " (*Ochroma Lagopus*), 603.

Bamboo : as paper-making material, 636.

Bambusa nana, Bambusa tulda : from Mauritius, used in paper-making, 636.

Banana : Cultivation, 595. – Encouragement of cultivation in Martinique, 658. – Stalks used in manufacture of furfural, 108.

" Bara-bara " (*Diospyros guainensis*), 635.

" Baramalli " (*Tabebuia* sp.?) British Guiana wood used in paper-making, 635.

" Barbasco " : Peruvian plant furnishing insecticide powders for large scale application, 820.

Barley : Impurities in seeds from various countries, *p.* 1138. – Phosphoric acid content, *p.* 937. – Influence of nitrifying bacteria on growth of b., *p.* 431. – Cultivation of b., by spaced row and hoeing system, 616. – Experiments with fallow, 619. – Cultivation in Holland, *p.* 386. – Cultivation in Roumania, *p.* 346. – Hygienic conditions in Belgium, *p.* 90.

" Bardy reed " : in paper-making, 636.

Baskets of alfa fibre, 912.

Beans : Presence of substances similar to Insulin in B., 573. – Cultivation in Holland, *p.* 386. – in Roumania, *p.* 681, *p.* 683 – Hygienic conditions of B. in Belgium, *p.* 92.

Beech : Amount of air-dried leaf-fall, and composition of leaf-litter, *p.* 407, *p.* 408. — Beech-mast : poisonous to horses, *p.* 336.

Beetroot : see Sugar Beet.

Belgian Congo : Albert National Park, 508. – Livestock diseases, *p.* 64. – Tropical Graminae harmful to pastures and stock in B. C., 54.

Belgium : Excusing of Certificates of origin for Superphosphates of B. and Luxemburg imported into France, 884. – Phytopathological problem in B., *p.* 88. – Agricultural education in B., 156. – Mechanical Laboratory of Solbosch University, Brussels, 897. – Activities of Belgian Peasants' Union, 942. – International Federation of Aviculture, 694. – *Congresses and Conferences* : Franco-Belgian Conference of Small Holders, 1924., 473. – International Congress on Technical Instruction, Charleroi, 1925, 198. – International Confrence on Tropical rubber and allied industries, 1924, 193. – II International Conference for Unification of formula for heroic remedies, 1925, 952. – Maritime and Colonial Congress, 1925, 959. – *Exhibitions* : of Farm Machines and products and Grand Agricultural Week, Brussels, 1925, 215. – Grand International Poultry Exhibition, Brussels, 1925, 208. – *Fair* : International Poultry F., Brussels 1925, 982.

" Belhambra " (*Phytolacca dioica*), as fodder, 841.

Bent grass (*Agrostis vulgaris*) : manuring of, 578.

Birch : composition of leaf-ash, *p.* 407.

Bison : protection of European b. in Sweden, 249.

Bleekrodea tonkinensis, 316.

Bibliography : ancient Anglo-Saxon manuscripts on Botany, 514. – American B. of Natural Sciences, 1024. – B. of Soil Science : *Biology of the Soil*, *p.* 164, *p.* 450, *p.* 757. – *Chemistry of the Soil*, *p.* 165, *p.* 449, *p.* 756. – *General* : *p.* 164, *p.* 448, *p.* 755, *p.* 1087. — *Regional* : *p.* 165, *p.* 353, *p.* 758, *p.* 1089. – *Soil Nomenclature, Classification and Mapping*, *p.* 165, *p.* 451, *p.* 758, *p.* 1089. – *Soil Physics*, *p.* 165, *p.* 448, *p.* 775, *p.* 1087. – *Soil and Vegetation*, *p.* 165, *p.* 451, *p.* 757, *p.* 1089.

Bifora sp., *p.* 1138.

Biographies : on Pomology and Pomolgists, 1037. – A proposed Biographical Entomological Dictionary, 251.

Bird-lime : Control of trade on the Ivory Coast, 886.

Birds : Insectivorous b., protected in Spain, 394. – B. as agents for the spread of " lamziekte ", *p.* 59. – International Congress for the study and protection of b., Luxemburg, Apr. 1925, 464.

Bolivia : International Manufactures Fair, La Paz, August 1925, 983.

Bonjeania recta : *p.* 1153, *p.* 1154.

Book-keeping : Monograph of agricultural costing in Rumania, 766. – Enquiry as to results obtained by Farm accountancy, *p.* 789. – Courses in A. B. k. at Brugg, Aargau, 437.

" Bossù " (*Maricaria saccifera*), Brazilian Oil-Palm, 755.

Botanic gardens and seed exchange : 675.

" Boulbènes ", *p.* 1071.

Bouteloua : Experiments on B. to determine plant production as a measure of environment, 564.

Brassica campestris, *p.* 1169, *p.* 1170, *p.* 1171. – *B. elongata*, *p.* 1101. — *B. nigra*, *p.* 1164, *p.* 1168.

Brazil : Agricultural development, 2 226 ; in 1924, 1011. – Official data on agricultural development, 743. – Agricultural problems, 496. – Report on progress in Brazilian agriculture, 756. – Government agricultural Service, 944. – Pro-

paganda by Co-operative research 898. – Agricultural experiments and instruction in 1924, 898. – Government seeds service, 943. – Yield of seed farm, São Simão, from 1920 to 1922, 444. – Dictionary of Valuable plants of B., 1021. – Experimental cultivation of Wheat in Rio Grande do Sul, 410. – Varieties of Maize cultivated in São Paulo, 304. – Coffee: New picking process, 234. – Reduction of price of C. for Home consumption, 141. – Export Trade, 757. – Cotton-growing, 309, 497. – Cotton service, 943. – Experimental Stations for c. growing in the State of Sergipe, 411. – Standardisation of C., 506. – "Curaua", new Brazilian textile fibre plant, 233. – "Babassù" and by-products industry, 226, 755, 850, 1020. – Oil palms, 755. – New Agricultural and zootechnical Services, 445. – Meat export trade, 757. – Sericultural Station at Barbacena, 898. – Hygienic organisation, 758. – Anti-malaria Campaign, 507. – Inquiry re increase of prices in B., 759. – *Laws*: re permanent production of Brazilian coffee, 386. – re Sericulture, 387. – Exemption from Customs Duties for certain Foodstuffs, 142. – *Agricultural Instruction and Experiments*: New Experimental Stations, 157. – Experimental Station for Cacao, 670. – *Congresses*: National Congress on products yielding Oil, Fat and Resins, 467. – Oil congress, São Paulo, 960. – Municipalities' Congress of Rio de Janeiro, 202. – Report of municipalities' Congress of Minas Geraes, June 1923, 468. – *Exhibitions*: Pernambuco municipal General Exhib. 1924, 216. – Agricultural and Pastoral Exhib. at Jaguarão, Rio Grande do Sul, Nov. 1924, 217. – Milk and derivatives Exhib., São Paulo, oct. 1925, 994. – *Agricultural periodicals*: *Ceres*, 1041.

Brazil nuts (*Bertholletia excelsa*), 226.

Breadfruit: varieties of seedless b. of the Pacific Archipelagoes, 78.

Breeding: See Genetics.

British East Africa: Experimental Agricultural Work in Tanganyika Territory, 424. – Coffee planting in T. T. 854. – Tea Enterprise in Kenya Colony, 746. – Reafforestation in T. T., 600. – *Costus afer* and *Amomum Granum-Paradisi* from Uganda in paper-making, 636.

British Guiana: Kartabo Laboratory of Tropical Biology, 929.

British Honduras: "Balsa" Wood, (*Ochroma Lagopus*), 630.

British India: Agricultural Experiment Institute, Indore, 423. – Soil Survey of Dialah Area, *p.* 753. – Liming of Assam soils, 4. – Cultivation of improved varieties of crops, 1015. – Technological Research Laboratory of Indian Central Cotton Committee, 930. – Cotton growing in Madras, 849. – Indigo cultivated in North Bihar 586. – Sugar Cane selection, North Bihar, 69. – *Cymbopogon coesius*, 593. – Aerial map of Forests of Irrawaddy Delta, 243. – Re-afforestation in Burma, 599. – Burma Oak and Chestnut Tans, 604. – Milk Industry, *p.* 781.

British West Africa: Agriculture, 1017. – Oil-Palm Industry, 1017. – Ivory Coast, Control of Cotton, rubber, rice, kola and bird-lime, 886. – Elephant grass from Sierra Leone for paper-making, 636.

British West Indies: Report of Agricultural Dept. of St. Vincent for 1923, 449. – Imperial College of Tropical Agriculture, Trinidad, 932. – "Uba" sugar cane in Jamaica, 246. – Experimental Sugar fac-

tory, Trinidad, 685. – Sugar Cane Experiments at Ste Madeleine, Trinidad, 425. – Arrowroot refuse from St. Vincent in paper making, 636.
Broad Beans : phosphoric-acid content *p.* 937. – Cultivation in Roumania, *p.* 681, *p.* 683 ; in Holland, *p.* 386.
Broccoli : Experiments in b. growing at Gulval, Cornwall, 683.
Bromus arvensis, *p.* 1098 *p.* 1105. – *B. madritensis*, *p.* 1154. – *B. rubens*, *p.* 1154. – *B. unioloides*, *p.* 1168, *p.* 1169, *p.* 1170.
Brunella vulgaris : *p.* 1105, *p.* 1115, *p.* 1118, *p.* 1127, *p.* 1130, *p.* 1131.
Buckwheat : Cultivation in Holland, *p.* 386.
Buckwheat-rash, *p.* 336.
Buffalo : Protection of European b. (bison) at Stockholm, 249. – Improvement of milk production of cow water buffalo, 91. – Milk production of water b., 92.
Buffer-action, of Soil (Influence), *p.* 417.
Bulbilis, 564 (see *Bouteloua*).
Bulgaria : Stock-breeding station at Chiiakovo, 899. – Stock-breeding Exhibition. Rasgrad, 995.
Bupleurum protractum, *p.* 1139. – *B. tenuissimum*, *p.* 1100, *p.* 1118.
" Burduf " (pressed cheese in skins, from Roumanian sheeps' milk), *p.* 975.
" Burity " (*Mauritia vinifera*), 755.
Butchery : Courses for butchers, Angers, France, 420.
Butter : Cause and prevention of disagreeable flavours in b., 362. – Co-operative sale in Belgium, 942. – B. industry in Egypt, 366. – Control of manufacture and export of b. in Latvia, 148. – B. industry in Holland, *p.* 391.

CABBAGE : As fodder for milch cows, 341 – Hygienic conditions in Belgium, *p.* 92.
Cacao : Experiments re fertilising of C. trees, 565. – Habit of budded c., 323. – Yield of budded C., 73. – Qualities in C., desired by manufacturers, 324. – C. in Brazil, 1011. – Programme, for Experimental Station for C. in Brazil, 670. – C., plantations encouraged in Martinique, 658.
Caesalpinia Sappan in tanning industry, 315. – *C. sepiaria* 76.
Cake : Ground-nut C. as tobacco fertilizer, 321. – " Babassù " oil-C., 850. – Tobacco-seed C., (fertilizer), 321. – Cotton C. as fodder, 84. – Palm-oil C. in Stock feeding experiments, 869. – Influence of different oil C. on fat-content of milk, 93. – Importation in Holland, *p.* 398.
Calluna vulgaris, *p.* 1078.
Calcium : influence of light rays on c. content of a growing organism, 331.
Calcium cyanamide : see Nitrogenous fertilisers.
Calepina Corvini, *p.* 1170.
Calophyllum Inophyllum, 852.
Calotropis gigantea, 807.
Calves : Feeding, 609.
Calycanthus, *p.* 333 – *C. praecox*, *p.* 332.
Camelina dentata, *p.* 1169.
Camphor : plantations in Hong Kong, 1014.
Canada : Vegetation and Forest cover map of C., 242. – Soil moisture investigations, *p.* 413. – Reports on Illustration Stations for 1923, 174. – Agricultural Experimental Stations, 172. – Phytopathological Laboratories, 173. – Dominion Waterpower and Reclamation Service, 947. – Impurities in Canadian Clover Seed, *p.* 1103, *p.* 1126. – Fruit-growing in British Columbia, 857. – 3rd World Poultry Congress and Exhibition, 1927, 199, 951. –

Canadian National Exhibition, Toronto, Aug. 1925, 1005. – Adoption of Metric System, 760.
Canarium copaliferum, 852. – *C. nigrum*, 852.
Canary seed. (*Phalaris canariensis*): among weed seeds of rice from Argentine, *p.* 1170. – Among weed seeds of flax from Argentine, *p.* 1169. – Cultivation in Holland, *p.* 386.
Canna edulis: Cultivation in Hawai, 839.
Cantharellus cibarius, 634.
Caracul: see Karakul.
Caraway: see Carvi.
Carex sororia, *p.* 1168.
« Carnauba » (*Copernicia cerifera ; Corypha cerifera*), 755.
Carbonic Acid Gas: useful against mould in sugar in storage, 903.
Carrots: Cultivation of fodder c. in Holland, *p.* 386. – C. as impurities in seeds, *p.* 1099, *p.* 1103, *p.* 1105, *p.* 1115, *p.* 1117, *p.* 1119, *p.* 1120.
Carvi: As impurities among red clover seed from Finland, *p.* 1100. – Missing from red clover seed from Canada, *p.* 1104. – Cultivation of C. in Holland, *p.* 386.
Cashew Nut Oil (*Anacardium occidentale*): Report on valuation tests made at Imperial Institute, London, 110.
Cassia aphylla, *p.* 1164, *p.* 1168. – *C. auriculata* as green manure, 807.
Castanopsis tribuloides, 604.
Castilloa elastica, 316.
Cattle: Classification of European breeds, 608. – Criteria for judging C. in Lower Austria, 991. – Competition for selection of black spotted Breton breed, 1001. – Breeds in Roumania, *p.* 974. – Importation into China of pure-bred North American C., 902. – Sex of long-carried Calves, 89. – Silage-feeding investigations, 84. – Vine shoots as C. feed, 607. – International C. breeding congress, the Hague, Aug. 1923, 192. – *Diseases*: Caused by deficiency in feeding, *p.* 58. – Abortion, *p.* 69. – Udder inflammation, *p.* 70. – See also: Bufalo – Calves – Cows – Meat.
Caucalis daucoides: *p.* 1170.
" Causses ", *p.* 1071.
Cecropis Juranyana, 635.
Celery: Hygienic conditions in Belgium, *p.* 92.
Celtis: Use of leaves of *C.* in hot-bed for germination of oil-palm nuts, 922.
Cenchrus tribuloides, *p.* 1103.
Centaurea Cyanus, *p.* 1175. – *C. maritima*, *p.* 1154. – *C. melitensis*, *p.* 1168. – *C. micranthos*, *p.* 1101, *p.* 1118. – *C. paniculata*, *p.* 1153, *p.* 1154. – *C. pannonica*, *p.* 1101. – *C. scabiosa*, *p.* 1098, *p.* 1099. – *C. solstitialis*, *p.* 1101, *p.* 1134, *p.* 1152, *p.* 1153, *p.* 1167.
Ceratocarpus arenosus, *p.* 162.
Cereals: power of germination *p.* 1176. – " Integral " (Rebello) method of cultivation of c., 711. – Spaced-row and hoeing system of cultivation of c., 616. – Cultivation and trade in Roumania, *p.* 338, *p.* 1104. – In Holland, *p.* 386. – Experiments in Nebraska, 673. – Artificial drying of C., by hot air, 104. – Congress of Wheat Growers of N. Africa, Algiers, 1925, 718.
Cerinthe, *p.* 333.
Ceylon: Rice cultivation, 45. – New Chemical Laboratory at Peradeniya, 931. – Tea planting, 855. – Varieties of coconuts in C., 49.
Chamber of Agriculture in Luxemburg, 403. – In Roumania, 892.
Cheese: Mammary Microflora in relation to C. making, *p.* 65. – Rou-

manian C., *p.* 975. – C. control in Denmark, 363. – C., industry in Egypt, 366. – C. industry in Holland, *p.* 391. – Regulations for control and marking of C. in Holland, 662. – *Nederlandsch Weekblad voor zuivelbereiding en Handel*, 1045. – See also : Milk-products.

Chemistry : 5th International Chemical Conference, Copenhagen, June-July, 1924, 457. – International Congress of Pure and Applied C., Bucharest, June 1925, 954. – Industrial week of Experts engaged in Chemical Industries, Turin, June 1925, 973. – General Assembly of German Chemical Societies of Food Industries, 958.

Chenopodium album, *p.* 1104, *p.* 1108, *p.* 1110, *p.* 1115, *p.* 1117, *p.* 1126, *p.* 1129, *p.* 1136, *p.* 1175. – *C. ambrosioides*, *p.* 1167, *p.* 1168. – *C. hircinum*, *p.* 1164, *p.* 1167, *p.* 1169. – *C. hybridum*, *p.* 1100, *p.* 1117. – *C. leptophyllum*, *p.* 1103. – *C. murale*, *p.* 1164, *p.* 1167, *p.* 1169.

Cheiranthus annuus : ionolysis, *p.* 13.

Cherry : Pollination, 77. – Hygienic conditions in Belgium, *p.* 93.

Chestnut : tannin value of C., 604. – Hygienic conditions in Belgium, *p.* 94.

Chick-peas : Cultivation in Roumania, *p.* 693.

Chicory : Cultivation in Holland, *p.* 386. – Seeds of c., as impurities in seeds, *p.* 1100, *p.* 1104, *p.* 1115, *p.* 1117, *p.* 1129.

Chile : Nitrate industry, *p.* 942. – Exportation of Nitrate, 561. – Nitrate costs in C., 1022. – Regulations for Sales of Nitrate, 881. – Provisions regulating sale of Fertilizers in C., 388. – Regulations for Advances of Seeds, 882. – Production of vegetable oils in C., 60. – Pomological Exhibition, Santiago, March 1925, 996.

China : Ling Nan Agricultural College, Canton, 900. – College of Agriculture and Forestry, University of Nanking, 901. – Agricultural Education at Peking University, 902. – Camphor plantation near Hong Kong, 1014. – Periodicals : *China Chemists' and Druggists' Review*, 525.

Chloropicrin : gaseous insecticide, 820.

" Chowrah " (red earth), *p.* 728.

Chrysanthemum cinerariaefolium, 820. – *C. coronarium*, *p.* 1139. – *C. inodorum*, *p.* 1098, *p.* 1105, *p.* 1115.

Chrysopsyche imparilis : Silk-producing Lepidopterous in French Guinea, 100.

Cider : C. industry, 105. – C. in France, 106. – C. apples, 858.

Cinematograph : for agricultural use in France, 397. – In Italy, 936. – Vine-growing and the C., 518. – C. in instruction on poultry-keeping, 510.

Cinnamon : oil from Seychelles, 593.

Cirsium arvense, *p.* 1104, *p.* 1125, *p.* 1129. – *C. lanceolatum*, *p.* 1164, *p.* 1168. – *C. palustre*, *p.* 1100.

Citrus Fruits : cultivation of c. f. in California, 594. – Grafting and selection, 38. – Lemons, 35, 294, 658. – Overseas transport, 114. – Propagation and cultivation of C. f. in Egypt, 76. – Use of Ethylene in colouring of c. f. 116.

Clover : Utilization of solar energy, 563. – Phosphoric-acid content, *p.* 937. – Country of origin of C. seeds, *p.* 1095. – Influence of origin on crop value of C. seed, 52. – Determination of characteristics of Southern seeds of C., *p.* 1141. – Austrian legislation re trade in C. seeds, 380. – C. seeds as impurities found in lucerne seed from Hungary, *p.* 1117. – Cultivation in Roumania, *p.* 681. – Cost of

production, 623. – Hygienic conditions in Belgium, *p.* 92.
Cobalt: presence in arable land, *p.* 1056.
Cocci: Mammary c., *p.* 84.
Coconut palm: Selection with reference to Fruit production, 851.– Varieties in Ceylon, 59. – In Indo-China, 314. – Copra-industry in the Philippines, 109. – Encouragement of c. p. cultivation in Martinique, 658. – Copra from Bahia, 850.
Coefficient: "Physiological coefficient", "technical coefficient", "c. of utilization of solar energy", 563. – "Vesicular c.," *p.* 412.
Coenostaegia sp., Silk-producing Lepidopterous (Liparidae family) in French Guinea, 100.
Coffee: New picking process, 234. – Cultivation in Brazil, 1011. – In Paranà, 1013. – Permanent protection of C., in Brazil 386. – Exportation from Brazil, 757. – Reduction of price of C. destined for home consumption in Brazil, 141. – C. plantations encouraged in Martinique, 658. – Experiments in Tanganyika Territory, 424. – Plantations in Tanganyika Territory, 854.
Cold Storage: Loss in weight of Stored apples, 118. – C. S. for Table Grapes, 119. – C. S. in Enology, 629. – Effect of C. S. on Egg germination, 97. – Progress in France in refrigerating industry applied to food preservation, 1000. – Heat technique in Solbosch University Mechanical Laboratory, Brussels, 897. – Italian Competition for Manufacture of Agricultural Refrigerators, 489. – Organisation of C. S. in Russia, 190.
Colloids: Soil c., their action on Lime and Bicarbonate of Lime, *p.* 427. – Investigations on Alkali Soil and Colloidal Phenomena, *p.* 139. – Maximum Water-retaining capacity of Colloidal Soils, *p.* 412. – Electrical Charge of Clay Colloids, *p.* 416 – Action of colloidal Sulphur on Germination of Potato tubers, 568. – National Institute for C. Research in U. S. A., 179. – *Kolloid Zeitschrift*, 774.
Colombia: Committee on Social Welfare and Agriculture in C., 178. – Activities of Agricultural Association of C., 696.
Colonization in Algeria, 656. – Internal c., in Italy, 764.
Colorimetry: instruction in c. at the National Bureau of Standards in Washington, 164.
Combustibles: Obtained from "babassù" coconut, 850. – National Bureau of Combustible liquids, (France), 701. – General Chart of the occurrence of Petroleum in Germany, *p.* 410. – Technical School for Study of Petroleum, Strasburg, 678. - First World Energy Conference, London, June-July 1924, 459. – Wood Charcoal Congress, Blois, April 1925, 967. – First International Exhibition of Gas and Water Industries, Padua, June 1925, 988.
Competitions: International: *France*: Rose Show, Bagatelle (Bois de Boulogne), 1925-1926, 484. – *Italy*: Viticultural Machinery, Barletta, 977. – National: *Argentine*: for Dairy cows, Buenos Aires, April 1925, 733. – *Austria*: Criteria for judging Cattle, 991. – *Brazil*: Regional seed c., 478.– *Denmark*: Fishing industries, 413. – *France*: for the finest ear of wheat, Bordeaux, Oct. 1925, 997. – For selection of black spotted Breton breed, 1100. – Autocars and gas-generators, Sept. 1925, 739. – General Agricultural Show, Paris, March 1925.,

487. – *Iceland* : Fishing industries, 413. – *Italy* : competition in agriculture, 690. – Soil improvement in S. Italy and Insular possessions 706. – For the largest ear of Wheat, 427. – Stock c., at Milan Fair, April 1925, 223. – Manufacture of Agricultural Refrigerators, 489. – For Smaller agricultural industries of Italy, 740. – *Spain* : Zootechnical c., Madrid, May 1926, 480. – Zootechnical c., Xeres de la Frontera, April, 1925, 481. – *Tunis* : Olive-pruning and grafting, 921.

Conferences : International : *Belgium* : 2nd I. C. for unification of formula for heroic remedies, Brussels, Sept. 1925, 952. – *Brazil* : I. cotton C., Rio de Janeiro 1922, 309. – *Great Britain* : Imperial Entomological, London, June 1926, 968. – *Hawai* : Sugar Planters and Manufacturers, Honolulu, July-Aug. 1924, 195. – Pan-Pacific Food Conservation C., Honolulu, 1924, 196, 461. – *Peru* : Pan-American C. on Standardization, Lima, Dec. 1924, 194. – *Poland:* 1st I. C. of Sugar-beet growers, Warsaw, June 1925, 955. – National : *Italy* : Horticultural c. of Royal Tuscan Society of Horticulture, Florence, 1925, 222. – *Spain* : Oil conference, Madrid, Nov. 1924, 471. – 7th International Congress of Olive-growers, Seville, 1924, 191. – *United States* : Annual meeting of Metric Association, Washington, Dec. 1924, 204. – National C. on utilization of Forest products., Washington, Dec. 1924, 205.

Congresses : International : *Argentine:* of Social Economy, Buenos Aires, 1924, 712. – *Belgium* : on Tropical Rubber products, and allied Industries, Brussels, April, 1924, 193 – On Technical Instruction, Charleroi, April 1925, 198. – *Canada* : World Poultry C. 1927, 199, 951. – *Czechoslovakia* : for scientific organization of Labour, Prague, July 1924, 460. – *Denmark* : 5th I. Chemical Conference, Copenhagen, June 1924, 457. – *France* : Technical Press C., Paris, Sept. 1925, 953. – Franco-Belgian Conference of Small-Holders, Lille, Sept. 1924, 473. – Timber, Lyons, Sept. 1925, 713. – Silk, Paris, June 1925, 956. – I. Dairy C., Paris, 1925, 197, 950. *Great Britain* : First I. Seed Trade C., London, 1924, 458. – Federation of Professional Horticulturists, London, 1924, 456. – World Energy C., London, June 1924, 459. – *Holland* : Cattle Breeding C., the Hague, Aug. 1923, 192. – *Italy* : Soil Science C. (International Institute of Agriculture), *p.* 455. – Organisation of 1st I. C. on Soil Science, *p.* 1091. – World's Forestry C., Rome, May 1926, 463. – I. Road C., Milan, Sept. 1926, 714. – *Luxemburg* : Int. C. for Study and Protection of Birds, April 1925, 464. – *Poland* : of Agriculture, Warsaw, June 1925, 200, 462, 711. – *Portugal* : of Science, Coimbra, June 1925, 954. – *Roumania* : of Pure and applied Chemistry, Bucharest, June 1925, 954. – *Spain* : of Olive-growers, Seville, Dec. 1924, 191, 454. – Second World Poultry Congress (Report). 957. – *Switzerland* : of Goat Keeping, Friburg, Sept. 1925, 465. – *United States* : 5th Int. C. of Soil Science, *p.* 458. – Int. Dairy C., Oct. 1923, 45. – National : *Algeria* : of Wheat growers, Algiers, Jan. 1925, 718. – *Argentine* : Cotton C., Corrientes, Sept. 1924, 732. – *Belgium* : Maritime and Colonial, Ostend, Aug. 1925, 959. – *Brazil* : of Municipalities of State of Minas Geraes, 468. – Of State of Rio de Janeiro, 202. – On Pro-

ducts yielding Oil, Fats and Resin, 467. – Oil, São Paulo, 960. – *Canada*: Fox C., Montreal, June 1925, 961. – *France*: of the " Association française pour l'avancement des Sciences ", Grenoble, July 1925, 717. – Agricultural, Rouen, May 1925, 966. – 5th Annual Meeting of the " Comptoir français de l'azote ", Paris, June 1925, 965. – Pomological C., Angers, Sept. 1924, 472. – Of Table Grapes, Agen, Aug. 1925, 964. – Wood Charcoal C., Blois, April 1925, 967. – Milling Industry, Paris, Oct. 1924, 206. – Of Fishery and Sea industries, Bordeaux and Arcachon, Sept. 1925, 963. – On Colonial Customs, Marseilles, June 1925, 716. – National Week for Exportation of Agricultural Products, 962. – *Germany*: " Agricultural Week " of the Deutsche Landwirtschafts-Gesellschaft, Berlin, Feb. 1925, 466. – German Colonial C., Berlin, Sept. 1924, 201. – General Assembly of German Chemical Societies of Food Industries, Münster, May 1925, 958. – *Italy*: Italian Association for progress of Science, Pavia, May 1925, 474, 726. – Agricultural Research, Rome, Apr. 1925, 721. – National Land Improvement, Naples, Sept. 1925, 971. – Of Tobacco growers, Bologna, May 1925, 976. – Of Olive growers, Bari, Oct. 1925, 969. – " Convegno del Pesco ", Canale d'Alba, Cuneo, July 1925, 972. – Forestry, Rome, May 1925, 720. – At Campobasso, Sept. 1925, 474, 970. – Viticulture and Wine-Making C., Casale Monferrato, Sept. 1924, 207. – On Vines and Wine (Italy), Trento, June 1924, 974. – Italian Wine Day, Milan, April 24th 1925, 723. – Italian Wine-makers Day, Milan, April 22nd 1925, 724. – Italian Wine Conference, Milan, April 1925, 725. – Of Sugar and Alcohol Industries, Ferrara, May 1925, 975. – Industrial Week of experts engaged in Chemical Industries, Turin, June 1925, 973. – Of Travelling Professorships of Agriculture, Rome, April 1924, 719. – Celebration of 25th Anniversary of the Travelling Professorship of Agriculture, Syracuse, April 1925, 722. – *Mexico*: C. of Stock Breeding and Veterinary Hygiene, Nov. 1924, 727. – *Spain*: 5th Nat. Irrigation C., Barcelona, May 1925, 469. – Of Vine Growers, Valentia, Nov. 1924, 470. – Oil Conference, Madrid, Nov. 1924, 471. – *United States*: 56th Convention of Farmers and Fruit growers, Sta. Ana, California, Dec. 1923, 203.

Conium maculatum, *p.* 1100, *p.* 1118.

Conventions: see Congresses.

Convolvulus arvensis, *p.* 1106, *p.* 1119, *p.* 1138, *p.* 1169.

" Coolibah " (*Eucalyptus microtheca*), 602.

Copernicia cerifera, 755.

Copra: from " babassù " and from coconut, 850.

Coriander (*Coriandrum sativum*): as impurity in Barley seed, *p.* 1138.

Coronilla scorpioides, *p.* 1104, *p.* 1142 to *p.* 1155. – *C. varia*, *p.* 1100, *p.* 1117.

Corylus Avellana, *p.* 404.

Coryphe cerifera, 755.

Costa Rica: Fruit Wines, 650.

Costus afer in paper making, 636.

Cotton: Research in relation to C. Cultivation, 310. – Rain grown C., 580. – Effect of irrigation on C., 846. – Disinfection of C., seed with Carbon Disulphide, 302. – Improvement of Queensland C. seed, 845. – Inheritance of Petal spot in « Pima » C., 39. – Spacing of C. crops, 880. – Manuring for

C. production, 311. – Community C. production, 498. – Brazilian Government C. service, 943. – Brazilian C. standards, 506. – Furfural manufactured from C. seed bulbs, 108. – C. in paper-making, 636. – C. in various countries: *Anglo-Egyptiam Sudan*: development of C. growing, 745. – Climate in relation to C. growing, 847. – C. grading, 844. – *Argentina*: measures against C. parasites, 140. – *Brazil*, 309; in various states of B., 497. – Experimental station for C. cultivation in State of Sergipe, 411. – *British Empire*: production, 842. – Empire C. growing corporation, 183. – *British India*: Experimental Institute at Indore (Central India), 423. – Indian Central C. Committee's Technological Research Laboratory, 930. – C. growing in Madras, 849. – *Egypt*: perennial method of C. cultivation, 848. – Effect of Climate on c. growing, 847. – *Eritrea*, 581. – *Ivory Coast*: Control of C. trade, 886. – *Martinique*: Encouragement of C. cultivation, 658. – *Nyasaland*, 1016. – *Paraguay*: C. seed, 663. – *Peru*, 56. – *Queensland*, 582, 845. – C. grading, 844. – *Tanganyika Territory*: Experiments in C. cultivation, 424. – *Union of S. A.*: grading, 844. – *United States*: Pima and Upland C. in Arizona, 312.

Cover crops: see Fertilisers, Organic.

Cows: Classification of European breeds for milk-production, 608. – Calculating average production of a dairy herd, 872. – Milk-production and draught-efficiency, 874. Quantity and composition of milk in relation to milking intervals, 863. – Feeding experiments with dairy c., 873. – Effect of season on milk and fat production of Jersey C., 864. – Influence of different oil-cakes on fat-content of milk, 93. – "Babassú" flour in dairy c. feeding, 1020. – Effect of cane molasses on the digestibility of a complete ration for dairy C. 866. – Yeast as supplementary food for dairy C., 867. – Influence of diet of c., on the anti-scorbutic potency of milk, 94. – Production of C. milk with antirachitic properties, 95. – Mammary micro-flora, *p.* 65. – Enquiry re testing of Dairy C., *p.* 485, *p.* 781. – Enquiry re accuracy of results obtained by milk record associations, 871. – See also: Cattle, Milk, Milking.

Cratoxylon prunifolium, 852.

Crepis setosa, *p.* 1101. – *C. tectorum*, *p.* 1098, *p.* 1099.

Cropping systems: see Agricultural Methods and Land Reclamation.

Crotalaria juncea, 842.

Crystallisation, *p.* 1, *p.* 651.

Crystallons, *p.* 4.

Crystals: propagation of C. in a super-saturated solution, *p.* 651.

Cuba: "mosaic" of sugar Cane, 678. – National Association of Horticulture in C., 700. – International Sample Fair, Havana, Dec. 1925, 979.

"Cube" (see "Barbasco"), 820.

Cucubalus Vaccaria, *p.* 333.

Cucurbita maxima, *C. Pepo*: ionolysis, *p.* 13.

Cuphea petrolata, *p.* 1103.

"Curaua" (Brazilian Bromeliacea with textile fibre), 233.

Currant: Hygienic conditions in Belgium, *p.* 94.

"Curuà" (*Attalea spectabilis*), 755.

Cuscuta arvensis, *p.* 1101, *p.* 1115, *p.* 1118, *p.* 1175. – *C. chilensis*, *p.* 1164, *p.* 1165, *p.* 1167, *p.* 1168. – *C. racemosa*, *p.* 1164, *p.* 1165. *p.* 1167, *p.* 1168, *p.* 1175. – *C. Tri-*

folii, *p.* 1115, *p* 1117, *p.* 1167, *p.* 1168. – See : Dodder.
Cyanide : Fixation of Nitrogen as C., 14.
Cymbopogon coesius, *C. giganteum*, 593.
Cyprus : Essence of Thyme oil, 593.
Czechoslovakia : Note on agriculture, 750. – Synoptic Agropedological Map of C., *p.* 440. – Agronomical examination of soil in Welwarn district of C., *p.* 750. – Moravian Soils, *p.* 742. – Hydrogen-Peroxide Catalase of Marsh Soils, *p.* 105. – Nitrogen fixation in C., 771. – Impurities in red clover from C., *p.* 1129. – Improvement in pasture lands, 1019. – Beet crop in 1924, 853. – Beetroot soils in Bohemia, *p.* 1083. – Comparative yields of Beets in C., 588. – Horse-Breeding, 949. – Electrification of country districts, 250. – Agricultural Instruction, 438. – Agricultural Academy, 439. – International Congress of Scientific Organization of Labour, Prague, July 1924, 460. – School of Agriculture of Tetschen-Liebwerd, 938. – Instruction for milk Testers at Znaim, 940. – Agricultural Museum, 939. – Agricultural Exhibition, Prague, May 1925, 1008.

DACTYLIS GLOMERATA, *p.* 1098, *p.* 1105.
Dahomey : see French West Africa.
Dairy Cows : Enquiry on d. c. testing, *p.* 485, *p.* 781. – Enquiry re accuracy of Milk Record Association results, 871.
Danthonia spicata, *p.* 1103.
Datura Stramonium, *p.* 1169.
Daucus Carota : *p.* 1099, *p.* 1103, *p.* 1105, *p.* 1115, *p.* 1117, *p.* 1120, *p.* 1129, *p.* 1175.
" Deccan Hemp " (*Hibiscus cannabinus*), produced in British Empire, 842.
Decodon verticillatum, *p.* 1103.
Delphinium spp., *p.* 1130. – *D. Consolida*, *p.* 1100 ; 820.
" Dendé " (*Elaeis guineensis*), 755, 850.
Denmark : Botanic garden Copenhagen, 412. – 5th International Chemical Conference, Copenhagen, June 1924, 457. – Impurities in clover seed from D., *p.* 1098, *p.* 1104. – Cheese Control Experiments, 363. – Fishing industries competition, 413.
Derris elliptica, as an insecticide, 820.
Deserts : Formation, *p.* 158. – Temperature of the surface of D., *p.* 731. – Chemical decomposition in Egyptian d., *p.* 733. – Animal Life, *p.* 728.
Dessa earth : tobacco fertilisers, 321.
Dictionary of valuable plants of Brazil, 1021.
Digitaria spp., *p.* 1130. – *D. sanguinalis*, *p.* 1115, *p.* 1117, *p.* 1120, *p.* 1167
Diospyros guainensis : See " Barabara ", 635.
Diplotropis spp., 635.
Dipterocarpus alatus, *D. Dyeri*, *D. Duperreanus*, *D. insularis*, *D. intricatus*, *D. Jourdaini*, *D. obtusifolius*, *D. ortocarpifolius*, *D. puntatus*, *D. tonkinensis*, *D. tuberculatus*, 852.
Diseases of Cattle : International agreements for control of epizootic d. of c., 711. – International bureau of epizootics (France), 177. – Internal secretary glands and immunity, 605. – D. of c., due to defective nutrition, *p.* 58. – Epizootic abortion, 343. – Solar erythema, (" Hamra "), 344. – " Lamziekte ", *p.* 58. – Golubatz Fly in Rumania, 329. – Paralysis of Chickens due to Coccidiosis 862. – " Styfsiekte ", *p.* 63. – Avian tubercul-

osis, 82. – Annam veterinary service, 704. – Measures of control in Nyasland, 146. – Legislation in Switzerland, 152. – American Parasitological Society, 446. – Veterinary Hygiene Congress, Mexico, Novem. 1924, 727. – Microbiological course, Pasteur Institute, Paris, 169.

Distillation boiler, Löschnig system, 353.

Distilleries: Home Brandy D., in Low-Austria, 353. – In Czecho-Slovakia, 750. – Spanish regulations concerning Wines and Alcohol, 653. – National Congress (Italy) of Sugar and Alcohol industries, Ferrara, May, 1925, 975.

" Djamba Cotton " (*Terminalia macroptera*), 100.

Dodder: Effect of dry heat on d., 577 - Report of D. Committee, *p.* 1175. – D. in tests of Argentine seeds, *p.* 1176. – See *Cuscuta*.

Domestic Economy (Agricultural): Instruction in Belgium, 156. – League of Farmwomen's Clubs, in Belgium, 942. – International Exhibition of modern improvements in town and country domestic work, Laecken (Belgium), 477.

Dracocephalum parviflorum, *p.* 1103.

Drought and Soil erosion in South Africa, 709.

Dry-farming: Soil evaporation, 563. – " Integral " method of cereal cultivation as measure of drought control, 711. – Experiments in Apulia, 935. – Experiments in Spain, 349.

Duck: artificial infection of d. for experimental purposes with " Lamziekte ", *p.* 39.

" Duivel Tree Planter ", 762.

Dunes: Dune-sand for grape-growing, *p.* 728. – Forestry value of D., *p.* 744.

Dung: See organic fertilizers.

Dutch East Indies: Tea planting 765. – Artificial fertilizers for Tobacco crops, 6. – International Sample Fair, Bandoeng, June 1925, 985. – Periodicals: " *De Indische Culturen* ", 529.

ECHINOSPERMUM LAPPULA, *p.* 1137, *p.* 1140.

Echium violaceum, *p.* 1170.

Ecology: *p.* 766. – Aim of agricultural e., 823. – Plant production as a measure of environment, 564. – Origin and geographical affinities of the Flora of California, 824.

Ecuador: Agricultural and Stock-breeding Services, 697.

Eggs: E. of tuberculous fowls in the transmission of avian tuberculosis, 82. – Effect of cold on germination, 97. – Preservation of shelled e., 367. – Co-operative sale of e., in Belgium, 942. – Exportation from Holland, *p.* 392, *p.* 399.

Egypt: Soil formation, *p.* 159. – Chemical decomposition in deserts of E., *p.* 733. – Cotton growing in relation to climate in E., 847. – Perennial method of cotton cultivation in E., 848. – Propagation and cultivation of citrus trees in E., 76.

Eimeria avium, 862.

Eleaeis guineensis, 755, 850.

Electricity: Research re applications of E. to agriculture, 911. – Power from small streams for farms, 879. – Electrification of country districts of France, 1028 – of Czechoslovakia, 250. – Electrical motors for agriculture, 711. – El. conductivity of extracts from soils and its use in detecting infertility, *p.* 147. – Electrometric Titration for determination of Soil relaction, *p.* 739 – Electrodes used in Soil moisture determinations, *p.* 411. – Electrical charge of clay colloids, *p.*416. – Influence of electric light on plant

growth, 566. – Atmospheric electric currents and plant growth 829. – Growing of Poles for elec tric transmission, 601. – *Eucalyp tus* species for supply of Poles (as above), 860. – Hydraulic power in Bavaria, 504. – First World Energy Conference, London, June 1924, 459. – International Exhibition of "White Coal", Grenoble, May-Oct. 1925, 485.

Electrogenetic Laboratory at Belgirate, *p.* 10.

"Elephant grass" (*Pennisetum purpureum*), 636.

Enology: Refrigerator plant in e., 629. – E. in Russia, *p.* 17. – Spanish regulations re e., 653. – Intensive course in viticulture at Pamplona (Spain), 414. – Protection of typical Italian Wines, 516. – Transformation of Royal Experimental Wine-making depots of Barletta, Velletri and Noto, 176. – Viticultural and Wine-making Congress, Casale Monferrato, Sept. 1924, 207. – Congress on Vines and Wine, Trento, June 1925, 974. – Italian Wine Conference, Milan, April 1925, 725. – Italian Wine Day, 24th April 1925, 723. – Italian Wine-makers' Day, 22nd April 1925, 724.

Enquiries: on Stock breeding services and higher instruction in Stock breeding, *p.* 788. – On prevention of Anthrax infection of herds, *p.* 788. – On testing of dairy cows, *p.* 485, *p.* 781. – On results obtained by Farm accountancy, *p.* 789. – On Locust Control: in Cirenaica, *p.* 787. – In Egypt, *p.* 484. – In Eritrea, *p.* 483. – In Italian Somaliland, *p.* 483. – In Tripoli, *p.* 788. – In Hungary, *p.* 468. – On Olive Fly (*Dacus oleae*) control in Turkey, *p.* 484.

Enterococcus, *p.* 71.

Eosin: action of e., on organisms of plants and animals, *p.* 335.

Epiphora beauhiniae, Silk producing Lepidoptera in French Guinea, 100.

Equines: Indices, *p.* 988. – Ass, *p.* *p.* 982. – Horse, *p.* 59, *p.* 973, *p.* 982; 339, 340, 383, 393, 711. – Mule, *p.* 982. See also: Stock Raising.

Eriobotrya bengalensis, 858.

Eritrea: cotton growing, 581.

Erysimum orientale, *p.* 1136, *p.* 1137.

Erythema (solar): see "Hamra", 344.

Essences: see Perfume plants.

Essences of fruits: extraction and concentration by means of refrigerator plant, 629.

Esthonia: Importation of Live Cattle and Animal Products, 883.

Eucalyptus: Qualities and uses of *Eucalyptus Globulus* (Blue Gum), 80. – of *Eucalyptus saligna* (Saligna Gum), 81. – Species of E., valuable for telegraph poles, 601.

Eucalyptus acervula, *E. Boistoana*, *E. botryoides*, *E. corynocalyx*, 860. – *E. crebra*, 601, 860. – *E. eugenioides*, *E. gigantea*, 860. – *E. Globulus*, 80, 860. – *E. gummi*, *E. hemiphloia*, *E. laevopinea*, *E. longifolia*, *E. Macarthuri*, 860. – *Eucalyptus microtheca*, 602. – *E. Muelleriana*, 860. – *E. paniculata*, 601, 850. – *E. pilularis*, 860. – *E. saligna*, 81, 860. – *E. siderophloia*, 601. – *E. sideroxylon*, 601, 860. – *E. viminalis*, 860.

Euchlaena mexicana, 835, 1026.

Eugenia Jambolana, 76.

Euphorbia maculata, *p.* 1103. – *E. Preslii*, *p.* 1103, *p.* 1120.

Eupteris aquilina, *p.* 1077.

Euterpe edulis, 635.

Exhibitions: International: *Argentina*: Live stock show, Palermo (Buenos Aires), Sept. 1924, 729. – Hygiene, Art and Industry, Ro-

sario, 1925-26, 978. – *Belgium*: Poultry, Brussels, Jan. 1925, 208. – Modern Improvements in Town and Country Domestic Work, Laeken, July 1925, 477. – *Bolivia*: Int. Manufactures Fair, La Paz, Aug. 1925, 983. – *Canada* : World Poultry Congress and E., 1927, 199. – *Cuba*: Horticulture, Havana, Feb.-March 1925, 479. – *France*: Poultry and Bee-keeping, Lyons, Jan. 1925, 210. – " Société des Aviculteurs du Nord ", Lille, Dec. 1 1925, 980. – " White Coal " and Tourist Facilities, Grenoble, May-Oct. 1925, 485. – *Great Britain*: Int. Food, London, April 1925, 488. – Imperial Ex., Wembley Park, London, Apr.-Oct. 1925, 220, 981. – *Italy* : Gas and Water Industries, Padua, June 1925, 988. – *Latvia*: Int. Ex. and Fair, Riga, July-Aug. 1925, 984. – *New Zealand* : Int. and South Seas, Dunedin, Nov. 1925, 211. – *United States*: Scheme for Colonial Ex. at New York, 483. – Permanent Ex. of Int. Trade, New Orleans, 482. – Rubber and Tropical Products, Boston, 734. – *Uruguay* : Sheep Show, Montevideo, Feb. 1924, 213. – National : *Argentina* : Agricultural, Buenos Aires, Apr. 1925, 733. – *Belgium* : Farm machines and Products, Brussels, Feb. 1925, 215. – *Brazil* : Pernambuco Municipal, Oct. 1924, 216. – Agricultural and Pastoral, Jaguarão, Rio Grande do Sul, 217. – Agricultural Live Stock, 993. – Milk and its derivatives, São Paulo, Oct. 1925, 994. – *Bulgaria* : Stock breeding, Rasgrad, 1925, 1995. – *Canada*: Canadian Nat. Ex. Toronto, Aug.-Sept. 1925, 1005. – *Chile* : Pomological, Santiago, March 1925, 996. – *Cuba* : Stock breeding, Havana, 1926, 736. – Poultry, Havana, Feb. 1925, 737. – *Czechoslovakia*: Agricultural, Prague, May 1925, 1008. – *France* : Lower Rhine Horticultural, Strasburg, June 1925, 999. – Agricultural Tractors, Versailles, Sept.-Oct. 1925, 998. – *Germany*: Travelling Ex. of German Agricultural Society, Stuttgart, June 1925, 990. – Sugar, Magdeburg, May-June, 1925, 731. – Transport, Munich, June-Oct. 1925, 493. – *Gold Coast* : Colonial Ex., March-Apr. 1925, 221. – *Great Britain* : Nat. Commerce, Liverpool, July 1925, 1004. – Annual Sanitary Ex., Edinburgh, July, 1925, 1003. – British Empire Ex. Wembley, 1924, 220, 981. – Textile Machinery, Manchester, October 1925, 1002. – *Indo-China*: French Indo-Chinese Fair, Hanoi, Nov.-Dec. 1924, 219. – *Ireland* : Flax, Lambeg, Belfast, Oct. 1924, 224. – *Italy* : Nat. Land-improvements, Naples, Aug. 1925, 1006. – Of Pure and Applied Chemistry, Turin, 1925, 490. – Forestry Congress and Ex. Campobasso, Sept. 1925, 491, 970. – Industry, Commerce and Agriculture, Fiume, Aug. 1925, 492. – *Persia* : Agriculture, Teheran, Aug. 1925, 1007. – *Poland* : Horticulture, Lvoff, Sept.-Oct. 1925, 494. – *Switzerland* : Agriculture, Berne, Sept. 1925, 495. – *Turkey* : Floating Ex. on S.S. " Kara Deniz ", 1925, 1009. – *United States*: Chemical Ind., New York, Sept. 1925, 735. – *Uruguay* : Agricultural Products, Montevideo, June 1924, 741.

Explosives : sub-soiling experiments, *p.* 731.

FAIRS : International : *Belgium* : Poultry, Brussels, Sept. 1925, 982. – *Cuba* : Int. Sample F., Havana, Dec. 1925, 979. – *Dutch East Indies* : Int. Sample F., Bandoeng,

June 1925, 985. – *Finland* : Finnish F., Helsingfors, 989. – *France* : Int. and Colonial Sample F. Bordeaux, June 1925, 986. – *Germany* : Int. F. Frankfort, 1925, 728. – *Indo-China* : French Indo-Chinese F., Hanoi, Nov.-Dec. 1924, 219. – *Italy* : Book Fair, Florence, June 1925, 987. – *Latvia* : Int. F. Riga, July-August 1925, 984. – *Spain* : Int. Sample F., Barcelona, 1925, 209. – *Switzerland* : Colonial and Exotic products F., Lausanne, June-July, 1925, 212, 730. – National : *Argentina* : Agricultural, Apr. 1925, 733. – *Austria* : Vienna F., 992. – Alpine Agricultural F., Innsbruck, Oct. 1924, 214. – *France* : Seeds F., Versailles, Jan. 1925, 218. – Paris, Jan. 1925, 486. – Gastronomic F., Havre, Apr. 1925, 1000. – *Germany* : Publicity F., Leipzig, March 1925, 476. – *Italy* : Stock competitions at Milan F., apr. 1925, 223. – *Switzerland* : Swiss Sample F., Bâle, Apr. 1925, 225.

Fallow : Experiments with f., 619.

Fauna : South Australian, 513. – Canberra Museum for Study of Australian F., 684. – Protection of Antarctic F., 769. – Animal Life in Deserts, *p.* 728. – For micro-fauna of the Soil, see Soil Science.

Federated Malay States : Work of Department of Agriculture, 184. – Rubber research, 426. – Singapore office of Epidemiology, 941. – Rice growing, 47. – Sisal Hemp Cultivation, 584. – Jelutong, 587. – Vetiver roots from Malay, 593.

Fermentation : *Chemie der Zelle und Gewebe*, periodical dealing with f., 519.

" Fertilisa de Pion-Gan ", 435.

Fertilizers : *General* : F. and Fertilizing, 268. – F. tests with and without Ground Limestone, 556. – Artificial F., for tobacco crops, 6. – Experiments re F., in Olive cultivation, 912. – Pond Fertilizing, 878. – Chemical F., in Austria since the War, 281. – Provisions re sale of F., in Chile, 388. – Repression of fraud in F. industry, France, 654. – German Research Laboratory for Chemical F. 666. – Imported Chemical F., in Holland, *p.* 398. – Methods for testing Artificial F., *p.* 428. – Standardisation of methods of analysis of F., 711. – *Organic Fertilizers* : Availability of Nitrogen in O. F., 807. – Utility of Stable Manure Nitrogen, *p.* 435. – Mauritian Pen Manure, 272. – Nitrifying Bed for prevention of Nitrogen losses from Cattle Urine, 557 Comparative Value of Alfalfa and Sweet Clover on Soils, *p.* 1079. – *Calotropis gigantea*, *Cassia auriculata*, *Pongamia glabra*, as green manures, 807. – " Silani " (" *Vigna marina* ") as Cover Crop, 579. – Cover plants for rubber, 63. – Oil-cake residues as F., for tobacco crop, 6. – Manurial value of Sugar Cane by-products, 558. – Deficiency in Nitrate caused by application of wood waste, *p.* 435. – Injury caused to Plants by mixing sawdust with soil, *p.* 440. – Availability of Nitrogen in Peat, 273. – Marine F., in Galicia (Spain), 274. – Walpole Island Phosphate Deposits, 7. – Guano as tobacco fertilizer, 321. – *Boletin de la Compañia Administradora del Guano (Lima)*, 782. – *Nitrogenous F.* : World Situation re Nitrogen Problem, 561. – Chilean Nitrate Industry, *p.* 942. – Chilean regulations for Sale of Nitrate, 881. – Use of N. F. encouraged in France, 396. – 5th Annual Reunion of the " Comptoir Français de l'Azote " Paris, June 1925, 956. – Available Nitrogen

in F., 16. – Transformation of Nitrogenous compounds in Soil, 563. – Effects of additions of Nitrogen, Phosphorus and Potassium on Nitrogen Economy, *p.* 438. – Effect of Lime on fertilizing action of Nitrogen, 15. – Action of Manganese Sulphate on Mineralisation of Nitrogen, 562. – Influence of progressive applications of Nitrate on quality of Sugar Beets, 67. – Increasing Ammonia production with improved Catalysts, 815. – Sources of Ammonia in Potato F., 17. – Nitrate Costs in Chile, 1022. – Chemical and Biological Studies on Calcium Cyanamide, 276, 278. – Cyanamide production in France, 767. – Decomposition of Calcium Cyanamide during Storage, 277. – Transformation of Cyanamidic Nitrogen, 277. – Present trend of developments in Nitrogen problem, 275. – Nitrogen problem in Italy, 1035. – Fixation of Nitrogen as Cyanide, 14. – Nitrogen fixation in Czechoslovakia, 771. – Manufacture of synthetic ammonia at Billingham, (G. Britain), 1033. – Report of American Research Laboratory for fixed Nitrogen, 676. – *Phosphatic F.*, Physiological Value of Phosphoric acid in Superphosphates and other phosphates, *p.* 921. – Economic use of Phos. F., 711. – Residual Effect of Acid and Rock Phosphates, 811. – Preparation of Phosphoric acid: Replacement of sand by Potash Silicates in Volatilization process, 808. – Sale of Morocco Phosphates, 768. – Basic Slags and mineral Phosphates, 559. – Reformphosphate, *p.* 932. – Rhenania-phosphate, *p.* 922; 281. – Sinter-phosphate, *p.* 922. – Preparation and Chemical nature of Calcined Phosphates, 8. – Manufacture of Phosphoric Acid by Volatilization process, 9, 10. – Degree of solubility of Phos. F., necessary for Plants, *p.* 725. – Phos. F., in the improvement of grass land, 55. – Phos. guano on Walpole Island (New Caledonia), 7. – Phos. F., in prevention of Osteophagy, *p.* 61. – Determination of Phosphoric Acid in F., 809. – Rapid determination of Available Phosphate in Soil, *p.* 145. – Determination of Phosphoric acid, *p.* 1057. – Analysis of Double Super-phosphates, 11. – Certificate of origin excused in the case of Superphosphates from Belgium and Luxemburg, 884. – Phosphatic manuring of Pastures in Western Australia, 810. – *Potash F.*: General Chart of occurrence of Potassic Salts in Germany, *p.* 410. – P., in Holland, 1036. – American P., 812. – Degree of solubility of P. F., necessary for Plants, *p.* 725. – Field Crop response to Potassium Salts, 13. – P. from cement dust, 814. – Recovery of P., from Steffan Waste Water, 560. – Potash from Kelp, 12. – *Catalytic and Biological F.*; Action of Manganese Sulphate in mineralization of Nitrogen, 562. – Effect of Manganese on Growth of Rice, 818. – Manganese Chlorosis of Pine-apples, 819. – Pot and Field experiments with Common Salt, 817. – Value of Sulphur in Soil improvement, 18. – Effects of Sulphur on Crop and Soils, 279. – Effect of Sulphur Oxidation on Solubility of Soil minerals, 280. – New system of Carbonification of Plants, 515. – Bavarian Bureau for the sale of Bacteriological cultures for increasing crop yields 442. – See also: Soil correction.

Fertilizing: see Soil Improvement.

Festuca sp., *p.* 162. – *F. pseudovina*, *p.* 1101.

Ficus elastica, 316. – *F. vetusa*, 76.
Filipendula ulmaria, *p.* 1100.
Finland: Brown earth in F., *p.* 402. – Impurities found in red clover seed from F., *p.* 1099, *p.* 1111. – 6th International Finnish Fair, Helsingfors, 989.
Fir: amount of needle-fall and composition of ash, *p.* 407. – Mortality of F. in the Wienerwald, *p.* 155. – See also Spruce.
Fish: Danish and Iceland Fishing industries, 413. – Italian scholarships for improvement of Studies relating to F., 693. – IXth National Congress of Fishery and Sea industries, Bordeaux and Arcachon, Sept. 1925, 963.
Flax: Utilization of solar energy, 563. – Weed seeds of F. from Argentina, *p.* 1169. – Inheritance and inter-relationship of principal characters of F., 843. – Prospects of Flax Fibre, 308. – Hygienic conditions of F., in Belgium, *p.* 92. – Cultivation in Czechoslovakia, 750. – In the British Empire, 842. – In Holland, *p.* 386. – In South Africa, 583. – Legislation in Austria re trade in f. seed, 380. – Exhibition of F., Lambeg, Belfast, Oct. 1924, 224.
Flies, and the spread of " lamziekte ", *p.* 59.
Flora: Californian, 824. – South Australian, 513.
Floriculture: Roses, 484.
Flour: Wheat F. and Bread regulations in Roumania, 891. – Beet F., 630. – F. from " Babassú ", as valuable cattle feed, 1020. – Bone meal f. in cattle feeding *p.* 61.
Flower Bulbs: Exportation from Holland, *p.* 396.
Flowering: see Phenology.
Foot-and-Mouth Disease: Influence on milk formation in cows, 639.
Forage: Deficiency of phosphorus in f. and livestock disease in S. Africa, *p.* 58. – Laminariæ (Algae) as f. for horses, 865. – See also Stock Feeding.
Forage Plants: Relation between agricultural value of meadow grasses and their anatomical structure, 282. – Modern trend of forage crop improvement, 51. – System of growing crops as f., for livestock, *p.* 671. – Manuring of grass land for hay, 578. – Deleterious graminae in Belgian Congo, 54. – Artificial drying of crops by hot air, 104. – Mangolds as f., *p.* 386; 563. – " Belhambra " (*Phytolacca dioica*) 841. – *Canna edulis*, in Hawai, 839. – Carrots as f., *p.*386. – Cabbage as f., in relation to flavour of milk, 341. – Lucerne (Alfalfa) *p.* 683; 52, 287, 291, 577. – *Melinis minutiflora*, 53. – Pasture land, 54, 55. – Potatoes as f., 341. – Wild Rice (*Zizania aquatica*), nutritive properties, 28. – " Silani " (*Vigna marina*), 579. – Soy bean harvesting, 840. – See also Forage.
Forestry: F. and agriculture, 598 – Transpiration of coniferous tree seedlings, 31. – Soils of the Wienerwald, *p.* 156. – Italian forest soils, *p.* 163. – F., value of sandy soils, *p.* 744. – Acidity of forest soils, *p.* 738, *p.* 1061. – Influence of soil acidity on growth of trees in N. W. Germany, *p.* 744. – Ammonification and nitrification of woodland soils, *p.* 436. – Experiments in acclimatising forest plants in Tanganyika Territory, 424. – Scientific methods of F. in Harvard forest, Petersham, U.S.A., 161. – Systems of forest cultivation, *p.* 666. – V. National F. Congress and Exhibition, Campobasso, Sept. 1925, 970. – Eucalyptus, 80, 81, 601, 602, 860. – Pencil cedar (*Juniperus procera*),

79. – Trees suitable for electric transmission poles, 601, 860. – " Duivel Tree Planter " for transplanting, 762. – Reafforestation in Lower Austria, 1010. – Hygienic conditions of forest trees in Belgium, *p.* 94. – F. in Czecho-Slovakia, 750. – Improvement of f. properties of mountain communities in Italy, 748. – F. in Spain, 391, 651, 652. – National Forest reserve, New Hampshire, U.S.A., 744. – Reafforestation in Tanganyika Territory with Cedar (*Juniperus procera*), 600. – Reafforestation in Palestine, 241. – Aerial map of forests of Irrawaddy delta (India), 243. – Reafforestation in Burma, 599. – " Coolibah " timber (*Eucalyptus microtheca*) in Western Australia, 602. – Control of forest diseases and pests in Spain, 651. – Regulations re tree felling in Spain, 652. – Federal Forest legislation, U.S.A., 143. – Protection of Forests in Venezuela, 665. – 50th Anniversary of Experimental Forestry Institute, Mariabrunn, (Austria), 896. – Centenary of Nancy National School of Waters and Forests, 914. – Experimental F. institutes in Germany, 894. – Exper. F. Inst. at Giessen (Upper Hesse), 407. – Higher F. instruction in Hungary, 934. – F. experimental station in Pacific region (U.S.A.), 160. – 50th anniversary of Colorado Springs (U.S.A.) Forest experiment Station, 159. – College of Agriculture and F., University of Nanking, China, 901. – F., instruction in Japan, 430. – Western Australian F. report, 710. – Isle of Réunion F. service, 703. – World's F. Congress, Rome, May 1926, 463. – I National F. Congress, Rome, May 1925, 720. – Wood Charcoal Congress, Blois (France), April 1925, 967. – National Conference on utilization of Forest products, Washington, (U. S. A.) Nov. 1924, 205. – Viennese Agriculture and F. Club (Austria), 695. – Work of the Federation " Pro-Montibus " (Italy), 707. – I Italian F. exhibition, Campobasso, 1925, 491. – Periodicals : *Centralblatt für das gesamte Forstwesen*, 1040.

Fotui (*Jacaranda Copaia*), 635.

Fourcraea gigantea, 842.

Fox (Fur) : Fox Congress, Montreal, Canada, June 1925, 961.

Foxtail (*Alopecurus pratensis*) : manuring, 578.

France : Soils of Pays de Gex (Ain), *p.* 1082. – Geology of the Sarthe, *p.* 1084. – Cyanamide production in F., 767. – Excusing of certificate of origin for superphosphates from Belgium and Luxemburg imported into F., 884. – Classification of varieties of wheat cultivated in F. and French N. Africa, 1027. – Impurities in barley seeds, *p.* 1138. – Impurities in clover seeds, *p.* 1132. – Vine-training in Lower Languedoc, *p.* 350. – International Bureau of Epizootics, 177. – Selection of Black Spotted Breton breed, 1001. – Supervision of production of Silkworm eggs, 885. – Promotion of rural engineering, 1025. – Work of the " Comité Central de culture mécanique ", 702. – Electrification of country districts, 1028. – Cider industry, 105. – Olive industry, 354. – National Bureau of Combustible liquids, 701. – *Laws* : Repression of fraud in Fertilizer industry, 654. – Encouragement of the use of Nitrogenous fertilizers, 396. – Regulations re trade in Cereal Seeds, 655. – Cinema for Agricultural use, 397. – *Agricultural instruction and experiments* :

Schools of Agriculture, 918. – Agricultural research, 682. – " Colonie-Sciences " Association, 945. – Microbiological course at Paris Pasteur Institute, 169. – Experiments in Olive Cultivation, 912. – Centenary of Nancy National School of Waters and Forests, 914. – School for Shepherds at Rambouillet, 168. – Technical courses in Butchery at Angers, 420. – Instruction in Poultry keeping, 915. – Experiments in Sericulture, 916. – Diploma of Expert Producer of Silk worm Seeds, 917. – Agricultural Subjects for Prize competition, 919. – Popular courses in agriculture, Paris, 417. – Girls' Agricultural School at Belville, 419. – Farm School for re-education of disabled men, 418. – Agricultural educational journey in Alsace, 920. – Cinema and poultry keeping, 510. – School for Study of Petroleum, Strasburg, 679. – *Congresses*: International C. of Technical Press, Paris, Sept. 1925. 953. – " Association Française pour l'avancement des Sciences » at Grenoble, July 1925, 717. – " Comptior Français de l'Azote ", Paris, June 1925, 965. – Pomological, Angers, Sept. 1924, 472. – Table Grapes, Agen, Aug. 1925, 964. – Franco-Belgian Conference of Small Holders, Lille, Sept. 1924, 473. – International Timber C., Lyons, Sept. 1925, 713. – Wood Charcoal C., Blois, Apr. 1925, 967. – International Dairy C., (Paris 1925) 197; (May 1925) 950. – International Silk C., Paris, June 1925, 956. – Milling industry C., Paris Oct. 1924, 206. – Fishery and Sea Industries C., Bordeaux and Arcachon, Sept. 1925, 963. – French National Week for export of agricultural products, 962. – Colonial Customs C., Marseilles, June 1925, 716. – *Exhibitions and Fairs*: " Société des Aviculteurs du Nord " Ex., Lille, Dec. 1925, 980. – Lower Rhine Horticultural Ex., Strasburg, June 1925, 999. – Agricultural Tractors, Vrsaillles, Sept. 1925, 998. – International Poultry and Bee-keeping Ex. Lyons, Jan. 1925, 210. – International and Colonial Sample Fair, Bordeaux, June 1925, 986. – National Seeds Fair, Versailles, Jan. 1925, 218. – Gastronomic Fair, Havre, Apr. 1925, 1000. – *Competition* for finest ear of wheat in F., Bordeaux, Oct. 1925, 997. – Periodicals: *Les fastes de l'agriculture*, 1042. – *Revue Scientifique*, 1043.

French Guinea: see French West Africa.

French Oceania Settlements: Measures for protection of plants, 659.

French West Africa: Professional School of Agriculture in Porto-Novo (Dahomey), 681. – Experimental Station Pobé (Dahomey), 923. – Experimental Station, La Mé, Ivory Coast, 922. – Breeding of Merino Sheep in Haute-Volta, 887. – Silk producing Lepidoptera in French Guinea, 100.

French West Indies: Encouragement of various plantations in Martinique, 658.

Frost: Effect of autumn f. on flavour of olives, 912.

Fruit: Röntgen Rays and the Examination of f., 244.

Fruit growing: Experiments in f. g., in Tanganyika Territory, 424. – Identification of deciduous tree stocks, 22. – Method of transplanting young trees by " Duivel Tree Planter ", 762. – Fruit preservation technique 113. – F. g. in British Columbia, Canada, 857. – in Czechoslovakia, 750. – Instruction in f. g. in Germany, 154. –

Annual of Swedish Pomological Society, 1046. – Fruit trees in Holland, *p.* 396. – Swiss experimental institute for f. g., 433. – Proceedings of Convention of Farmers and Fruitgrowers at Sta Ana, California, Dec. 1923, 203. – Pomology and Pomologists, 1037. – Pomological Exhibition, Santiago, Chile, 1925, 996. – Almond, 596. – Apple: 117, 300, 631, 632. – Banana, 108, 595, 658. – Bread fruit: 78. – Cherry, 77. – Chestnut, 604. – Citrus fruits: 35, 38, 76. 114, 115, 294, 594, 658. – Peach, 972. – Pear, 117, 289. – Walnut, 597. – See also: Fruit.

Fruit wines, 650.

Fumaria capreolata, *p.* 1168.

Fungi: Vitamine content, 634. – Substances similar to insulin extracted from F., 570. – Absorption of urea by F., 571.

Fungicides: Recent progress, 820.

Furfural: Manufacture, 108. – Production of F. from corn cobs and oat hulls, 107.

GALEGA OFFICINALIS: *p.* 1100.

Galeopsis dubia, *p.* 1130. – *G. Ladanum*, *p.* 1099, *p.* 1101, *p.* 1130. – *G. Tetrahit*, *p.* 1100, *p.* 1111.

Galfinia brasiliensis, *p.* 1169.

Galium sp., *p.* 1175, *p.* 1131. – *G. caudatum*, *p.* 1129. – *G. tricorne*, *p.* 1108. – *G. uliginosum*, *p.* 1100.

Gardens: Copenhagen Botanic G., 412. – Catalogue of Plants in G. of acclimatization of Orotava (Canary Isles), 235. – Rio de Janeiro Botanic G., 898. – In Czechoslovakia, 750. – In Holland, *p.* 396. – Horticultural instruction in Germany, 154. – Conference on gardening, (United States), 907.

"Garigues", *p.* 663.

Gases: Radio-activity of eruptive g. of Vesuvius and influence on development of bacteria and higher vegetation, *p.* 327.

Genetics (animal): Climate and Fecundity, 88. – Questions of Breed, 870. – Importance of local breeds, 711. – Modification of the coat in mammals, 337. – Heredity in the Mule, *p.* 982. – Selection of Black Spotted Breton breed, 1001. – Sex of long-carried calves, 89. – Improvement of milk-production by Cow-Buffaloes, 91. – Improvements in Sheep breeding in Morocco, 875. – Poultry selection, 877. – Cross-breeding of first generation in Poultry rearing, 90. – Reaction on Sexual Hormone of mucous Tissue of Cock's Comb, 606.

Genetics (Plant Breeding): Electrogenetic Laboratory at Belgirate (Italy), *p.* 10. –Progress in Cultivation of improved varieties of Crops (India), 1015. – Pure seed production (Italy), 688. – in Kingdom of Serbs, Croats and Slovenes, 151. – Heteromorphism and the law of Triple Convergence, 295. – Selection of drought-resisting grain and forage plants (S. Italy), 935. – Seed Fund (Latvia), 888. – Selection in different plants: *Wheat*: "Yeoman II" (Great Britain) 1030. – Inheritance of Pubescence of the Nodes in Crosses of 2 varieties of W., 298. – Inheritance of resistance to rust in crosses of *Triticum durum*, 833. – Origin and value of "Bena" Wheat, 44. – Selection of W. in Roumania, *p.* 338. – Genetic relation between *Triticum dicoccum* and similar morphological types, 296. – Hybrids from *Triticum* and *Aegilops*, 297. – *Oats*: New varieties, 834. – *Maize*: Number of Chromosomes, 299. – Origin, 835. – Origin and production of new varieties, 1026. – Seed-ear characters and productiveness in M., 836. –

Improvement, 574. – In Queensland, 41. – Comparative texts of Philippine varieties, 575. – *Rice*: Machine winnowing of seed, 576. – Improvement of varieties in Ceylon, 837. – Mass selecting in Philippine rice fields, 40. – Selection in Malaya, 47. – *Forage crops*: Modern trend of improvements, 51. – Vistula Horse-Bean, 306. – *Potatoes*: Sprouts as index of seed value, 43. – Experiments in Scotland, 48. – Seed p., improvement methods in U.S.A., 42. – *Ornamental plants*: Study of, in U. S. A., 905. – *Industrial plants*: *Nicotiana deformis* and Enzymatic theory of Heredity, 34. – Inheritance and inter-relationship of principal characteristics of Flax plant, 843. – Inheritance of Petal spot in " Pima " Cotton, 39. – Cotton in Peru, 56. – Improvement in cotton seed in Queensland, 845. – Factors affecting Protein and Oil content of Soy beans, 58. – Sugar-Cane Cytology, 36. – " Uba " Sugar-Cane (Jamaica), 246. – Bud Selection in Hawaiian Sugar plantations, 37. – Selected Canes in Nord Bihar (British India) 69. – New Sugar Cane varieties at Porto Rico, 248. – *Fruit trees*: Inheritance of composition in Fruit through vegetative propagation, 35. – Acclimatization of apples to tropical countries, 858. – Pollen germination Capacity of certain varieties of apples and pears, 300. – Selection in relation to grafting on acid-fruit trees, 38. – Yield and growth in *Hevea brasiliensis*, 65. – Coconut-palm selection, 851. – In Ceylon, 59.

Genista germanica: *p.* 1078.

Geology: Treatise, *p.* 410, *p.* 729.

Geranium dissectum, *p.* 1098, *p.* 1105. – *G. molle*, *p.* 1098, *p.* 1105. – *G. pusillum*, *p.* 1098, *p.* 1105.

Germany: Agricultural Situation in 1924, 742. – Soil cultivation and National farming, *p.* 156. – Geological map of Bavaria, *p.* 142. – German phenological service, 668. – " Karl-Heinz-Thost Foundation " for phenological study, 669. – General chart of occurrence of Potassic Salts and Petroleum in G., *p.* 410. – Research Laboratory for Chemical fertilizers, 666. – Bavarian Bureau for sale of materials for increasing crop yields, 442. – Experimental stations at Lauchstadt and Gross-Lubars, 893. – Horticultural Institutes at Berlin-Dahlem, Geisenheim am Rhein, and Proskau, 154. – Experimental Forestry Institutes, 894. – Soil and Forest development in the Syke district of N. W. Germany, *p.* 744. – Hydrological Research Station at Obernachtal, 667. – Courses in rural mechanics (Bavaria), 895. – Hydraulic power in Bavaria, 504. – German agricultural delegation in U.S.A., 754. – General assembly of Food industries, 958. – German agricultural Society's Travelling Exhibition, 990. – Winter session in Berlin " Agricultural Week ", Feb. 1925, 466. – German Colonial Congress, Berlin, Sept. 1924, 201. – Periodicals: *Zeitschrift für technische Biologie*, 519. – *Die Laboratoriumspraxis*, 255. – *Kolloidzeitschrift*, 774. – *Deutsche Bergwerks-Zeitung*, 773. – *Deutsche Landwirtschaftliche Presse*, 520, 772. – *Allgemeine Forst- und Jadgzeitung*, 521. – *Technik und Wirtschaft*, 522. – *Ratge ber für den Maschinbetreib*, 254.

Goat; G. keeping in Malaga, 345. – G. breeding in Roumania, *p.* 976. – " Lamziekte ", *p.* 59. – International G. congress, Friburg, Sept. 1925, 465.

Gold Coast: Sisal-Hemp plantations,

313. – Vetiver roots, 593. – Colonial Exhibition, March 1925, 221.
Golubatz Fly, 329.
Grafting: Habit of budded Cacao, 323. – Yield of budded C., 73. – *Hevea* bud g., 64. – Olive g. (Tunis), 921. – Selection and g. of acid-fruit trees, 38. – Apple g., 858. – Vine g., report on work of Higher Horticultural School at Geisenheim am Rhein, 154.
Grape: Chemistry of pigments, 293. – Cold storage for table grapes, 119.
Grape residues: derivatives extracted by refrigerator plant, 629.
Grasslands and pastures, 54, 55, 748.
Great Britain: British Committee of Agricultural Meteorology, 448. – Sub-Soiling trials, 1924, 618. – Manufacture of Synthetic Ammonia at Billingham, 1033. – English Wheats, 499. – "Yeoman II" seed Wheat, 1030. – Improvement of Grassland in Yorkshire, 55. – Variety trials of Potatoes, 838. – Potato trials in Scotland, 48. – Experiments in acclimatizing Scotch potatoes in Austria, 307. – Sugar beets, 240, 511, 761. – Textile fibres at British Empire Exhibition, Wembley, 220. – Progress of Empire Cotton-growing Corporation, 183. – English Avicultural Annual, 1044. – *Laws*: Annual agricultural returns, 399. – *Agricultural experiments and instruction*: Government Subventions, 170. – Scientific Research Workers, 928. – Agricultural research, 682. – Imperial College of Tropical Agriculture, 422. – Report of Colonial Research Committee (1923), 421. – Colonial Settlers' College, 927. – Timber Technology section at Imperial Forestry Institute, Oxford, 924. – Scottish Experimental Stock Farm, 925. – Dairy Experimental Institute at Reading, 171. – Apple packing stations, 946. – Training of Agricultural organizers and lecturers, 926. – International Society for the History of Science, 447. – *Exhibitions*: British Empire Ex., Wembley Park, London, 1925, 981. – Textile Machinery, Manchester, Oct. 1925, 1002. – Annual Sanitary Ex., Edinburgh, July 1925, 1003. – National Commerce Ex., Liverpool, July 1925, 1004. – *Congresses and Conferences*: International Seed Trade C. (reports), 1924, 458. – International Federation of Professional Horticulturists, London, 1924, 456. – 1st World Energy C., London, June-July 1924, 459. – Imperial Entomological Conf., London, June 1925, 968. – Periodicals: *Agricultural Progress*, 780. – *Feathered World*, 1044. – *India Rubber Journal*, 528. – *World's Rubber Position*, 751.
Green manuring: 711. – See also: Fertilisers, organic.
Grindelia brachystephana, *p.* 1168.
Growth of Live Stock, Influence of light rays on calcium content of normal growing organism, 331. – Mineral Metabolism of the Growing Pig, 346. – Size of Animals and Law of Bergmann and Dépéret, 336. – Stimulating influence of Vitamine preparations on growth, 334. – Changes in Chemical composition of the Tissues of Herring in relation to Maturity, 333. – Exose Phosphoric Esters in Ossification, 332.
Growth of Plants: Changes in Hydrogenion Concentration produced by growing seedlings in Acid Solutions, 33. – Environment and plant life, 563. – Influence of duration of light on growth, 566. – Atmospheric electric currents and their relation to g. of p., 829. – Factors affecting growth of Crops

on acid soils, *p.* 154. – Effect of Soil Alkali on g. of p., *p.* 745. – Growth period of Wheat, 567.
Guano : See Fertilizers.
"Guarana" (*Paullinia Cupana*) or "Varana", 226.
Guatemala : Maize cultivation, 305. Periodicals : *Agricultura*, 256.
Guinea pig : Artificial infection with "lamziekte", *p.* 59.
Gypsum : see Soil correction.

"HAIARI-BALLI", 635.
Haiti : Official agricultural institutions, 165. – Manual of Agriculture for Lower and Rural Schools, 166.
"Hamra" (*Hypericum perforatum*) and solar erythema, 344.
Hawai : Iron, Aluminium and Magnesium in Soil of H., *p.* 147. – Bud selection in Sugar plantations in H., 37. – Edible Canna cultivation, 839. – Pan-Pacific Research Institute, Honolulu, 153. – International Conference of Sugar-planters and Manufacturers, Honolulu, 1924, 195. – Pan-Pacific Food Conservation Conference, Honolulu, 1924, 196. – Report, 461.
Hay : United States Grades for h., 112. – See also Fodder.
Hazel : Amount of potash in forest litter, *p.* 407. – *Corylus Avellana* in Finland, *p.* 404.
Hedeoma pulegioides, *p.* 1103.
Hedge plants, 76.
Hedypnois polymorpha, *p.* 1154, *p.* 1155.
Helianthus uniflorus : ionolysis, *p.* 13.
Helmintia echioides : *p.* 1101, *p.* 1104, *p.* 1152, *p.* 1153, *p.* 1154, *p.* 1155.
Helichrysum Stoechas, *p.* 1153.
Hemp : Cultivation in Czechoslovakia, 750. – Production in British Empire, 842. – New Zealand h. (*Phormium tenax*) grown in British Empire, 842.
Hevea : Rubber planting questions, 62. – Cover plants for Rubber, 63. – H. bud grafting, 64. – Yield and growth of *H. brasiliensis*, 65. – Rubber tapping experiments, 66. – Plantations in Cochin-China, 228. – In Indo-China, 316. – Rubber-drying experiments, 356. – Rubber research in Malaya, 426. – General Association of Rubber Planters of East Coast of Sumatra Experimental Station, 432. – *India Rubber Journal*, 528.
Hibiscus cannabinus, 842. – *H. ternatus*, *p.* 1101. *H. trionus*, *p.* 1101.
"Hog Plum", *Spondias lutea*, 635.
Holcus lanatus, 578.
Hopea dealbata, *H. ferrea*, *H. odorata*, *H. Pierrei*, *H. Recopei*, *H. Thorelli*, 852.
Hops : Cultivation in Czechoslovakia, 750. – Hygienic condition of h., in Belgium, *p.* 92.
Hordeum vulgare, as weed seeds of wheat, *p.* 1170.
Hormones : see Sexual hormones.
Horse : H. breeding, 711. – H. in mule breeding, *p.* 982. – Encouragement of h. breeding in Austria, 383. – Light-h. in Austria, 340. – H. breeding in Czechoslovakia, 949. – H. breeding in Roumania, *p.* 973. – Remount Stations in Spain, 393. – H., in Indo-China, 339. – "Lamziekte", *p.* 59.
Horse-Bean : Investigation on the Vistula H., B., 306. – Cultivation in Holland, *p.* 386.
Horticulture : Antirachitic properties imparted to green vegetables by ultra-violet irradiation, 335. – H. in Czechoslovakia, 750. – In Holland, *p.* 396. – Hygienic conditions of market garden plants in Belgium, *p.* 92. – Intermediate and higher instruction in h., in Belgium, 156. – In Germany, 154. – In Poland, 189. – In Swit-

zerland (Wädenswill), 433. – Royal Tuscan Society of H. (Florence) Conferences, Jan., Feb., March, Apr. 1925, 222. – National Association of H., Cuba, 700. – 6th Congress of International Federation of Professional Horticulturists, London, May 1924, 456. – International H. Exhibition, Havana, Cuba, Feb.-March 1925, 479. – Lower Rhine Horticultural Exhibition, Strasburg, June 1925, 999. – National H. Exhibition, Lvoff, Poland, Sept.-Oct. 1925, 494.

Hubu (*Spondias lutea*), 635

Humus: Formation and decomposition of Humus in Soil, *p.* 733. – Humus in certain Moravian Soils, *p.* 742.

Humus phosphate (Stoklasa), *p.* 922.

Hungary: Impurities in barley seed, *p.* 1138. – Impurities in clover and lucerne seed, *p.* 1100, *p.* 1115, *p.* 1117, *p.* 1118. – Cost of production of Sugar beet, 627. – Higher Forestry instruction, 934. – Periodicals: *Chemische Rundschau für Mitteleuropa und Balkan*, 259.

"Huon pine": Essential Oil from, 593.

"Hurowassa" (*Pithecolobium trapezifolium*), 635.

Hydraulics: Reservoir Construction in Idaho, (U. S. A.), 237. – Power for Farms from small streams, 879. – Canadian Dominion Water-power and Reclamation Service, 947. – International Exhibition of Gas and Water industries, Padua, 1925, 988.

Hydrocyanic Acid as a Toxic Agent to Plant growth, 827. – Hy. A. content of Sorghum, 569.

Hygiene (Cattle): Disinfection of stables, 861.

Hygiene (rural): organization in Brazil, 758. – Anti-Malaria Campaign in Rio de Janeiro (Brazil), 507. – In Italy, 517. – In Spain, 395. – Singapore Office of Epidemiology, 941. – Annual Sanitary Exhibition, Edinburgh, June 1925, 1003.

Hyperrhenice glauca, 355.

"IDEALPHOSPHATES": 281.

"Inadaya" (*Attalea humilis*), 755.

"Inaja" (*Maximiliana regia*), 755.

"Inayuca": (*Maximiliana speciosa*), 755.

Inchi grass (*Cymbopogon coesius*), 593.

Incubation: improvements, 1032.

Indices: of Asses, *p.* 988. – Of Mules, *p.* 997.

Indigo: cultivation in North Bihar (India), 586.

Indo-China: Sugar Cane in Cochin-China 320. – Tea plantations at Tranninh, 590. – Coconut palm, 314. – Rubber, 316. – Rubber in Cochin China, 228. – Stick-lac in Cambodia, 317. – Resins and Oleo-resins, 852. – Annam Veterinary Service, 704. – Horses, 339. – Machine Winnowing of Paddy seed, 576. – French Indo-Chinese Fair, Hanoi, 219.

Industries (Agricultural Ind.): New process for removal of Acid from oils and fats, 753. – A. ind. in Poland, 462. – Food-product ind. in Czechoslovakia, 750. – Lectures at Pittsburg (U.S.A.) Industrial Research Institute, 163. – Report of 1st Pan-Pacific Food Conservation Conference, 461. – Industrial Week of persons engaged in Chemical and allied ind., Turin, June 1925, 973. – German Chemical Societies of Food ind., general Assembly, March, 1925, 958. – International Food Exhibition, London, April 1925, 488. – Exibition of agr.: products, Brussels, February 1925, 215. – National Exhib-

ition of Pure and Applied Chemmistry, Turin, 1925, 490. – 1st Exhibition of Industry, Commerce and Agriculture, Fiume, Aug.-Sept. 1925, 492.

Insecticides: Recent progress, 820. – Some chemical problems of the i. industry, 821. – Determination of free Calcium Hydroxide in commercial Calcium Arsenate, 822.

Institutions: see Agricultural and Scientific Institutions and Associations.

Instruction (Agricultural) and Experiments: Enquiries on Stockbreeding services and higher instr. in Stockbreeding, *p.* 788. – Agr. instr. at Warsaw Congress, June 1925, 711. – Collective exp., over long periods, reported at Warsaw Congress, 711. – Research on applications of electricity to agriculture, 911. – *Albania*: American-Albanian College of Agr. and Trade, 181. – *Australia*: Agr. Research Institute, Adelaide, 687. – Australian Settlers' College (G. Britain), 927. – Canberra (N. S. Wales) National Museum for study of Austr. Fauna, 684. – *Austria*: Vienna Higher School of Agriculture, 409. – Recent developments of agr. instr. in Lower A., 408. – Exper. Station of Agr. Chemistry, Imst, Tyrol, 155. – Exper. Forestry Institute, Mariabrunn, 896. – *Belgium*: 156, 942. – Mechanical Laboratory of Solbosch University, Brussels, 897. – International Congress on technical instr., Charleroi, Apr. 1925, 198. – *Brazil*: Agr. instr., during 1924, 898. – New Exper. Stations, 157. – Exper. in Wheat cultivation, Rio Grande do Sul, 410. – Exper. in cotton growing, in Sergipe, 411. – Exper. in Cocoa cultivation, 670. – *Bulgaria*: New Stock-breeding Station, 899. – *Canada*: Phytopathological laboratories, 173. – Agr. illustration Stations, 174. – *China*: Ling Nan Agr. College, Canton, 900 – College of Agriculture and Forestry, Nanking University, 901 – Agr. instr., Peking University, 902. – *Cuba*: Endowment for studies re "Mosaic" of Sugar Cane, 678. – *Czechoslovakia*: 438, 439. – School of Agriculture, Tetschen-Liebwerd, 938. – Agr. Museums, 939. – Instr. for Milk testers, Znaim, 940. – *Denmark*: Copenhagen Botanic Garden, 412. – *Federated Malay States*: Rubber research in Malay, 426. – *France*: Agr. Schools, 918. – Agr. research, 682. – Popular courses in Agr. in Paris, 417. – Farm Schools for disabled men, 418. – Girls' Agr. School at Belleville, 419. – Agr. subjects for prize competition, 919. – Cinematograph and Vine growing, 518. – Exper. in Olive cultivation, 912. – Nancy National School of Waters and Forests, 914. – Technical courses in Butchery, Angers, 420. – Vocational School for Sphepherds, Rambouillet, 168. – Instr. in Poultry keeping, 915. – Cinematograph and Poultry keeping, 510. – Exper. in Sericulture, 916. – Diploma for Expert Producer of Silkworm seeds, 917. – Technical School for study of Petroleum, 679. – Destruction of valuable collections of the "Laboratoire d'Agronomie coloniale", 913. – Agr. educational journey in Alsace, 920. – *French West Africa*: La Mé (Ivory Coast) Exper. Station, 922. – School of Agriculture, Porto-Novo (Dahomey) 681. – Pobé (Dahomey) Exper. Station, 923. – *Germany*: "Karl-Heinz-Thost Foundation" for German botanists, 669. – German

Phenological Service Maps, 668. – Research Laboratory for Chemical fertilizers, 666. – Hydrological research station, Obernachtal, 667. – Exper. stations at Lauchstadt and Gross-Lübars, 893. – Higher Horticultural Institute of Berlin-Dahlem, Geisenheim am Rhein, and Proskau, 154. – Exper. Forestry Institutes, 894. – Exper. Forestry Inst., Giessen (Upper Hesse), 407. – Courses in rural mechanics, Bavaria, 895. – *Japan*: Forestry instr., 430. – *Great Britain*: Government Subvention for Agr. education and research, 170. – Agr. research, 682. – Scientific research workers, 928. – Report of Colonial Research Committee for 1923, 421. – Exper. on broccoli growing (Cornwall), 683. – Timber Technology section at Oxford Imperial Forestry Institute, 924. – Scottish exper. stock farm, 925. – Reading Dairy Exper. Institute, 171. – *British Guiana*: Kartabo laboratory of tropical biology, 929. – *British West Indies*: Imperial College of Tropical Agriculture, Trinidad, 422, 932. – Instr. and exper. at Sugar factory of Imperial College of Tropical Agr. Trinidad, 685. – Sugar cane exper. at Ste Madeleine, Trinidad, 425. – *Haiti*: Official Agr. institutions, 165. – Manual of Agr. instr., for lower and rural schools, 166. – *Hawai*: Pan-Pacific Research Institute, 153. – *Holland*: Catalogue of Geological and Agrogeological collections of Wageningen Higher School of Agriculture, 247. – *Hungary*: Higher Forestry Instr., 934. – *India*: Agr. exper. institute, Indore (Central India), 423. – Technological Research Laboratory of Indian Central Cotton Committee, 930. – Chemical laboratory at Peradeniya (Ceylon), 931. – *Italy*: Higher instr. in Agr. and Veterinary medicine, 401. – Agr. exper. and research, 175. – Anniversary of University of Pavia, 186. – Formation of Administrative Committees for Italian Royal agr. Stations, 428. – National Congress of Travelling professorships of Agriculture, Rome, 719. – in Syracuse, 722. – National Forestry Congress, Rome, May 1925, 720. – Bari Agr. exper. Station, 935. – Italian Association for progress of Science, Pavia, May 1925, 726. – International Institute of Agr. ecology (at the Int. Institute of Agriculture, Rome), *p.* 766. – Körner prize competition in organic Chemistry as applied to agriculture, 692. – Italian Scholarships for farm engineers, 689. – Production of pure seed, 688. – Wheat Cultivation improvement, 427. – Royal experimental Wine-making depôts at Barletta, Velletri and Noto, 176. – Prizes for dairy cow feeding, 691. – Scholarships for studies re Fish, 693. – Courses for rural mechanics at Rome, 429. – Development of Agri. cinematograph, 936. – *Morocco*: Native agr. School, Fez, 680. – *New Zealand*: Demonstration farm, 686. – *Palestine*: Hebrew University at Jerusalem, 933. – *Panama*: Model farm in Alanje district, Chiriqui Province, 167. – *Paraguay*: Agr. school at Asunción, 937. – Stock breeding school, Asunción, 431. – *Poland*: Agric. International Congress, Warsaw, June 1925, 462. – National Institute of Rural Economy, Pulawy, 189. – *Spain*: Popular Agr. instr., at Madrid, 158. – Agr. fields ("Campos agricolas") attached to National Schools, 671. – Intensive course in

Viticulture, Pamplona, 414. – Radiotelephony for diffusion of information on breeding of small livestock, 509. – *Sumatra*: General association of Rubber Planters, Exper. Station, 432. – *Switzerland*: Federal exper. seed texting institute, Lausanne, 435. – Federal institute for Agric. chemistry, Lausanne, 436. – Wädenswil exper. institute, for fruit and vine-growing and horticulture, 433. – Federal station of Viticultural exper. Lausanne, 434. – Agr., bookkeeping courses, Brugg, 437. – *Tanganyika Territory*: Experimental agric. work, 424. – *Tunis*: Agric. education, 921. – *United States*: Agr. exper. stations, university of Louisiana, 1923, 903. – University of Michigan biological station, 908. – Lehigh Research Institute, 162. – Franklin Institute and Reusselaer Polytechnic centenary, 180. – Rural science at Virginia Polytechnic Institute, 674. – Bequest for research work in agr. chemistry, 416. - National Institute for Colloid research, Wisconsin University, 179. – Boyce Thompson Institute for plant research, Yonkers, 415. – Report of American Research Laboratory for fixed Nitrogen, 676. – International seed exchange (Brooklyn Botanic garden), 675. – Nebraska exper. in cereal growing, 673. – Sugar beet exper. in Louisiana, 672. – Research fellowship in Chemistry of perfumes and essential oils, 906. – Gardening conference, 907. – Tropical plant research foundation, 904. – Study of ornamental plants, 905. – Forest station (Colorado Spring), 159. – Forest exper. station (Pacific region), 160. – Scientific methods of Forestry, Haward Forest, Petersham, 161. - Fund for Study of Wood Chemistry, 677. – Livestock exper. station, Miles City (Montana), 910. – Collection of type cultures of Bacteria of American Natural History Museum, 909. – Pittsburg Industrial Research Institute 163. – Colorimetry at National Bureau of Standards (Washington), 164.

Insulin: Substances similar to I. extracted from plants, 570. – Presence of substance similar to I. in beans, 573. – Influence of I. on milk secretion and composition, 330.

Iodine: Presence of I., in nature, 25. – Effect on Soils and Plants, *p.* 736.

Ionolysis, ionisation, *p.* 11.

Ipomoea aquatica, *p.* 676.

Ireland: Exhibition of Flax, Lambeg, Belfast, Oct. 1924, 224.

Iriartea exorrhiza, I. Orbigniana, 755.

Irrigation: I. and its practice, 102. – Systems of I., *p.* 676. – Methods of drought control, 711. – Water-divining, 505. – Relation between i. and plant growth, 614. – Potato production under i., 50. – Effect of i. on cotton plant, 846. – I. of citrus trees in S. California, 594. – I. in Argentina, *p.* 1163. – In Italy, *p.* 694. – In Peru, 56. – In South Africa, 615. – Drought Commision of Union of South Africa, 709. – Australian i. scheme (Queensland), 747. – Isle of Réunion Water and Forestry Service, 703.

Italy: Italian agriculture, 229. – Agricultural production, 230. – Competition in Agriculture ("Cesare Zucchini"), 690. – Home colonization, 500, 764. – State quinine, 517. – Geology of Istria, *p.* 1080. – Geological observations on ancient soils of M. Pisano, *p.* 446. – Soils to the east of the Catria

range, *p.* 446. – Radio-activity of eruptive gases of Mt. Vesuvius, *p.* 327. – Bacteria which fix Nitrogen in Vesuvian soils, *p.* 433. – Streptotriceae of Vesuvian soils, *p.* 433. – Sicilian red earth, *p.* 1081. *Soil Improvement*: Laws and decrees, 660. – National Land imp. Congress, Naples, Sept. 1925, 971. – National Federation of Land imp., Padua, 917. – Associations for soil imp. in Southern I. and the Italian islands, 706. – National Land imp. Exhibition, Naples, Aug. 1925, 1006. – Irrigation, *p.* 694. – *Vegetable production*: Nitrogen problem, 1035. – Pure seed pr., 688. – Impurities in red clover seeds from I., *p.* 1131. – Electro-genetic Laboratory at Belgirate, *p.* 10. – Competition for largest ear of wheat grown in I., 427. – Sugar cane industry in Sicily and Colonies, 245. – National Congress of Tobacco growers, Bologna, may 1925, 976. – " Convegno del Pesco ", Canale d'Alba, Cuneo, July 1925, 972. – Italian Olive growers Congress, Bari, Oct. 1925, 969. – Royal Tuscan Society of Horticulture, Florence, (Conferences), 222. – Vine growing and the cinematograph, 518. – International competition of Viticultural machinery, Barletta, 977. – Italian Forest soils, *p.* 163. – Improvement of grasslands and Pastures of Mountain Communities, 748. – " Parco nazionale d'Abruzzo", 948. – Federation " Pro-Montibus ", 707. – World's Forestry Congress, Rome, May 1926, 463. – National Forestry Cogress, Rome, May 1925, 720. – National F. C. and Exhibition, Campobasso, Sept. 1925, 970. – 5th F. C. Campobasso, 1925, 475. – *Animal production*: Order for higher instruction in Agriculture and Veterinary medicine, 401. – Stock Competitions at Milan Fair, Apr. 1925, 223. – Preparation of silkworm seed, 400. – Scholarship for studies relating to Fish, 693. – *Rural Industries and Transport*: Protection of typical Italian wines, 516. – Wine Conference, Milan, Apr. 1925, 725. – Viticultural and Wine-making Conference, Casale Monferrato, Sept. 1924, 207. – Congress on Vines and Wines, Trento, June 1925, 974. – Italian Wine Day, Milan, 24 Apr. 1925, 723. – Wine-makers Day, 22 Apr. 1925, 724. – Royal experimental Wine-making stations at Barletta, Velletri and Noto, 176. – Agricultural experimental station, Bari, 935. – Industrial week of experts engaged in Chemical and allied ind., Turin, June 1925, 973. – Gas and Water Ind. Exhibition, Padua, June 1925, 988. - National Congress of Sugar and alcohol Ind., Ferrara, May 1925, 975. – Olive industry, 354. – Endowment for study of feeding of dairy cows, 691. – International Road Congress, Milan, Sept. 1926, 714. – *Institutions*: Meeting of Italian Association of the progress of Science, Pavia, 24-28 May 1925, 726. – National Research Council, 450. – Special administrative Committees for Royal agricultural Stations, 428. – Foundation for Agricultural experiment and research, 175. – Conference on agr. research, Rome, Apr. 1925, 721. – Proceedings of the "Società Agronomica Italiana", 708. – Prize competition: Organic chemistry as applied to agriculture, 692. – Institute of agricultural economics and statistics, 185. – University of Pavia centenary celebrations, 186. – Scholarships for farm engineers, 689. – Courses

for rural mechanics, Rome, 429. – National congress of travelling Professorships of Agriculture, Rome, Apr. 1924, 719. – 25th Anniversary celebrations of Syracuse travelling Professorship of Agriculture, 722. – Development of agricultural cinematograph, 936. – *Press :* International Book Fair, Florence, June 1925, 987. – National Association of Agricultural Press, 451. – "*International Reports on Soil Science*", *p.* 166. – Yearbook of the Italian Agricultural Press, 181.

Ite (*Mauritia flexuosa*), 635. – See also Aete.

JACARANDA COPAIA, 635.

Japan : Laws : Agricultural Tenancy Arbitration, 402. – Forestry instruction, 430. – Gifts for libraries destroyed by earthquake, 188.

"Jarina" (*Phytelephas macrocarpa*), 226, 755.

Java : Soil types, *p.* 164. – Relation between climate and sugar production in J., 3.

Jelutong, 587.

Journals and Reviews : see Periodicals.

Jujube-trees : *Epiphora Beauhiniae*, Silk-producing Lepidoptera of French Guinea feeds on J., 100.

Jugoslavia : Soils in the Drina, Save and Morava areas, *p.* 751. – Impurities in barley seed from J., *p.* 1138.

Juncus bufonius *p.* 1100.

Juniperus procera, 79, 600.

Jute : production in the British Empire, 842.

KAPOK : production in the British Empire, 842.

"Karahora" (*Schefflera depressa*), 635.

Karakul : sheep breeding in Roumania, *p.* 975.

Kenya : see British East Africa.

Kephir : Flora and preparation processes, 364.

Koeleria, 564.

Kola nuts : Government Control of trade in K. n. (Ivory Coast), 886.

Krubera leptophylla, *p.* 1139.

Kurukoruru (*Diplotropis* sp.?), 635.

LAMINARIAE (Algae) : as fodder, 865.

"Lamziekte" : South African Cattle disease due to deficiency in phosphorus, *p.* 58.

"Landes", *p.* 663.

Land Reclamation : Dominion of Canada Water power and L. R. service, 947. – See also : Agricultural methods.

Lappula echinata, *p.* 1100, *p.* 1117.

Lapsana communis, *p.* 1104, *p.* 1105, *p.* 1130.

Lathyrus montanus, *p.* 1078. – *L. pratensis*, 578 ; *p.* 1100.

Latvia : Soils of Lettonia, *p.* 752. – Chalk in Lettonia, *p.* 750. – Production of seed for sowing, 147. – Fund for seed, 888. – Control of butter industry and export trade, 148. – 5th International Exhibition and Fair, Riga, July 1925, 984.

Laws : (Legislative and administrative measures) : *Algeria* : Colonisation, 656. – Checking the spread of *Diaspis pentagona*, 398. – *Argentina*: Against Pink Bollworm and other cotton parasites, 140. – *Austria* : Seed trade control, 380. – Against diseases and pests of plants, 381, 382. – Encouragement of horse breeding 383. – Re Bee diseases, 384. – Protection of Natural features of Lower-A., 385. – *Belgium* : Phytopathological legis., *p.* 97. – *Brazil*: Permanent production of Brazilian coffee, 386. – Re reduction of price of coffee for home consumption, 141. – Re exemptions from customs

duties of certain essential foodstuffs, 142. – Protection of sericulture in São Paulo, 387. – *British W. Africa* : Control of cotton, rubber, rice, kola and bird-lime (Ivory Coast), 886. – *Chile* : Sale of fertilizers, 388. – Sale of Nitrate of Soda, 881. – Advances of seeds, 882. – *Costa Rica* : Fruit wine production, 650. – *Esthonia* : re importation of live cattle and animal products, 883. – *France* : re excusing of certificates of origin for superphosphates imported into F. from Belgium and Luxemburg, 884. – Repression of fraud in fertilizer industry, 654. – Encouragement of the use of nitrogenous fertilizers, 396. – Cereal seed trade, 655. – Control of silkworm egg production, 885. – Re cinema for agricultural use, 397. – *French W. Africa* : Merino sheep-breeding in Haute-Volta, 887. – *French W. Indies* : Encouragement of various plantations in Martinique, 658. – *French Oceania*: protection of plants against parasitic diseases, 659. – *Great Britain* : Agricultural Returns Bill, 399. – *Holland* : re control and marking of cheese 662. – Re plant protection, 404. – *Italy* : re Land improvement and agricultural credits, 660. – Re preparation of silkworm seed, 400. – Re higher instruction in agriculture and Veterinary medicine, 401. – *Japan* : Agricultural Tenancy Arbitration, 402. – *Jugoslavia* : re seed selection and viticulture, 151. – *Latvia* : production of seed for sowing, 147. – Fund for seeds, 888. – Manufacture and export of butter, 148. – *Luxemburg* : Chamber of Agriculture, 403. – Re importation of oats for sowing, 889. – *Madagascar* : Regulation of sericulture, 145. – *Morocco* : re agricultural and silk-industries, 657. – *Paraguay* : re cotton seed, 663. – *Portugal* : reorganization of Ministry of agriculture, 405. – Re utilization of waste lands, 406. – *Rumania* : New wheat, flour and bread regulations, 664, 891. – Re testing of seeds of forage plants, 890. – Re encouragement of sericulture, 149. – Re institution of agricultural Chambers, 892. – *San Salvador* : re encouragement of agriculture, 150. – *Somaliland* : re control of plant diseases, 661. – *Spain* : Organization of agricultural and zootechnical services, 389. – Organization of anti-malarial prophylaxis, 395. – Tobacco cultivation, 390. – Reafforestation, 391. – Re control and protection of forests, 651. – Re felling of trees on private property, 652. – Remount stations for horses, 393. – Customs dues on farm tractors, 392. – Re wines and alcohol, 653. – Re protection of insectivorous birds, 394. – Re agricultural fields ("campos agrícolas") attached to National schools, 671. – *Switzerland* : against cattle disease, 152. – *Union of S. Africa* : Control of plant and animal diseases in Nyasaland, 146. – *United States* : Inspection Division, Department of the Interior, 144. – *Venezuela* : Protection of forests and water reserves, 665.

Laws of Bergmann and Dépéret and the size of animals, 336.

Leeks: Germinability of seeds, *p*. 333.

Leguminous Plants : seed crops in Roumania *p*. 680. – See also names of different species.

Lemon : Inheritance of composition in fruit through vegetative propagation, 35. – Isolation of antiscorbutic factor in lemon-juice, 294. – Encouragement of l. planting in Martinique, 658. – Research

re varieties resistant to canker, 1065.
Lentils: cultivation in Roumania, *p.* 681, *p.* 692.
Leopoldinia Piassaba, 755.
Lepidium campestre, *p.* 1126. – *L. densiflorum*, *p.* 1103. – *L. pubescens*, *p.* 1168, *p.* 1169. – *L. virginicum*, *p.* 1103.
Leucite : as potassic fertilizer, *p.* 726. – Utilization of l., 813.
Leucocytes in milk due to abnormal mammary microflora, *p.* 80.
" Leunasalpeter ", 281.
Lianas (rubber-producing) : Indo-China, 316.
Libraries : gifts for the Japanese libraries destroyed by the earthquake, 188.
Lima Bean (*Phaseolus lunatus*) : toxicity of, 29.
Lime : see Soil correction.
Limosella, *p.* 333.
Linum virginianum, *p.* 1103.
Liquidambar orientalis, *L. tonkinensis*, 852.
Lithospermum arvense, *p.* 1170.
Lobelia inflata, *p.* 1103.
Locusts, as fodder, 86. – In Iraq, *p.* 1182.
Loess : Formation and origin, *p.* 158.
Lolium, spp., *p.* 1130. – *L. aristatum*, *p.* 1101, *p.* 1117. – *L. multiflorum*, *p.* 1098, *p.* 1099, *p.* 1101, *p.* 1104, *p.* 1169, *p.* 1170. – *L. perenne*, *p.* 1098, *p.* 1099, *p.* 1101, *p.* 1104, *p.* 1115, *p.* 1117. – *L. temulentum*, *p.* 1169, *p.* 1170.
" Long John " (*Triplaria surinamensis*), 635.
Löschnig's distillation boiler, 353.
Lotus corniculatus, *p.* 1117, *p.* 1131, *p.* 1132.
Lublinite : carbonates in the form of l., in Ukrainian soil, *p.* 444.
Lucerne : Phosphoric-acid content, *p.* 937. – Country of origin and agricultural value of L. seed, *p.* 1095. – Characteristics of clover and L. seeds of southern countries, *p.* 1141, *p.* 1152. – L. from Turkestan, *p.* 1140. – Weed seeds frequently present among L. seed of Argentina, *p.* 1164. – As impurity found among red clover seed from Denmark, *p.* 1098. – From Roumania, *p.* 1129. – From United States, *p.* 1119. - From Hungary, *p.* 1115. – Effect of dry heat on L. seed, 577. – Seed innoculation of L. (*Medicago sativa*), *p.* 1076. – Value of L. and sweet Clover on Soils, *p.* 1079. – Isolation of a protein from the leaves of L., 291. – Influence of Sodium Chloride on growth of L., 287. – Cultivation of L. in Rumania, *p.* 681.
Lunaria biennis : ionolysis, *p.* 13.
Lupin : Utilization of solar energy, 563. – Content in phosphoric acid of *Lupinus luteus*, *p.* 937. – Influence of moisture and insolation on *Lupinus angustifolius*, *p.* 509. – Cultivation of l., 711. – Toxic action of l., *p.* 336.
Luxemburg : Chamber of agriculture instituted, 403. – Importation of oats for sowing, 889. – Exemption of superphosphates imported into France from L. from certificate of origin, 884. – International Congress for study and protection of birds, Luxemburg, Apr. 1925, 464.
Lychnis Githago, *p.* 1136.
Lycopus virginicus, *p.* 1103.
Lythrum Salicaria, *p.* 334.

MACHINERY : Recent innovations, 621. Farm implements and m., 103. – Gas and electric motors for agriculture, 711. – Hoeing systems, 616. – Mechanical tillage on sugar plantations, 617. – " Duivel Tree Planter " transplanting m., 762. – Portable m. for artificial drying of crops, 104. – Oil Palm M., 622.

– Motor crushers for vine shoots used as fodder, 607. – Promotion of rural engineering (France), 1025. – " Comité central de culture mécanique ", 702. – Courses in rural mechanics (Bavaria), 895. – Courses in rural mechanics (Rome), 429. – Russian requirements in agr. m. and implements, 502. – Exhibition of agr. m. (Brussels, Feb. 1925), 215. - International Exhibition of " White Coal " and Tourist Facilities, Grenoble, May-Oct. 1925, 485 – Exhibition of Agr. tractors, Versailles, Sept. 1925, 998. – Textile m. Exhibition, Manchester, Oct. 1925, 1002. – International competition of Viticultural m., 977.

Madagascar : Regulation of sericulture, 145.

Maize : High temperature and germination of m., 301. – Effect of varying supply of nutrients upon character and composition of m., *p.* 1078. – Consumption of oxygen by roots of m., 563. – Daily variation of carbohydrates in leaves of m., 27. – Origin, 835. – Origin and production of new varieties, 1026. – Number of chromosomes in m., 299. – Seed-ear characters and productiveness in m., 836. – Programme of m. improvement, 574. – Pure seed production in Italy, 688. – In Queensland, 41. – Superior varieties cultivated in São Paulo (Brazil), 304. – Comparative tests of 6 Philippine varieties, 575. – Spacing of crops, 880. – Experiments with fallow, 619. – Cultivation in Guatemala, 305. – In Rumania, *p.* 342. – Manufacture of furfural from corn-cobs, 107, 108. – Sweet corn drying, 120.

Malaria : anti-m. campaign in Brazil, 758. – In Rio de Janeiro, 507. – In Italy, 517. - In Spain, 395.

Malay : see Federated Malay States.

Malt : M. industry in Czechoslovakia, 750.

Malus dasyphylla, M. domestica, M. Doumeri, M. laosensis, M. sylvestris, 858.

Malva neglecta, p. 1117.

Mammary microflora, *p.* 65.

Manganese : action of m. sulphate in mineralization of Nitrogen, 562.

Mangels : Hygienic conditions in Belgium, *p.* 92.

Mango : not to be cultivated in proximity of citrus trees, 76.

Mangold : Cultivation of m. in Holland, *p.* 386. – Utilisation of solar energy by m., 563.

" Manicole " (*Euterpe edulis*), 635.

Manihot glaziowii, 316.

Manures : see Fertilizers :

Mapping : Soil m., *p.* 440. – S. m. in different countries, *p.* 1091. – Committee on nomenclature, classification and m. of Soils, *p.* 465. – Committee for Agro-Geological map of Europe, *p.* 466, *p.* 762. – German Phenological Service maps, 668. – Geological map of Bavaria, *p.* 142. – Synoptic Agropedological map of Czecoslovakian Republic, *p.* 440. – Chart of the occurrence of Potassic Salts and Petroleum in Germany, *p.* 410. – Bibliography, *p.* 164, *p.* 451, *p.* 758.

Maricaria saccifera, 755.

Marshes, *p.* 663.

"Massarandubas" (*Mimusops bidentata*), 226.

Mauritia flexuosa (Aete), 635. – *M. vinifera*, 755.

Mauritius : Mauritian Pen Manure, 272. – Bamboo from M. as paper-making material, 636.

" Mauritius Hemp " (*Fourcraea gigantea*) : Production in British Empire, 842.

Maximiliana regia, M. speciosa, 755.

Meat : Export trade from Brazil, 757.

Medicago denticulata, *p.* 1171. – *M. lupulina*, *p.* 1104, *p.* 1108, *p.* 1115, *p.* 1117, *p.* 1126, *p.* 1130, *p.* 1134. – *M. maculata*, *p.* 1171. – *M. sativa* : see Lucerne.

Medicinal Plants : China (Camphor), 1014. – *Paullinia Cupana*, 226. – II. Internat. Conference for unification of formula for eroic remedies, 952.

Melampyrum barbatum, *p.* 1101.

Melandrium album, *p.* 1117.

Melilotus spp., *p.* 1120, *p.* 1130; 828. – *M. albus*, *p.* 1079, *p.* 1126.– *M. officinalis*, *p.* 1115, *p.* 1117. – *M. parviflorus*, *p.* 1102, *p.* 1164, *p.* 1166, *p.* 1167, *p.* 1168, *p.* 1169. – *M. procumbens*, *p.* 1102.

Melinis minutiflora : Fodder value, 53.

Melon : Composition of Californian Cantaloupes and commercial maturity, 75.

Meteorology : British Committee of Agr. M., 448. – Activities of the International Institute of agr. ecology, *p.* 766. – Desert climate, *p.* 728. – Cotton growing in relation to climate in Egypt and Sudan, 847. – Forests and rainfall, 598. – Sulphur and Nitrogen in Kentucky rainfall, 1. – Wheat yield and rainfall in Ohio, 2. – Climate and sugar production in Java, 3. – Raingrown Cotton and Climate, 580. – Meteorological conditions and plant diseases, *p.* 369. – Rainfall in Roumania, *p.* 680. – Meteorological conditions in South Africa, 709.

Mexico : 1st Congress of Stock breeding and Veterinary Hygiene, Mexico, Nov. 1924, 727.

Microbiology : Course of instruction in m., at Pasteur Institute, Paris, 169.

Milk : Effect of feeding cabbage and potatoes on flavour and odour of M., 341. – M. production and draught efficiency, 874. – Quantity and composition of M., in relation to milking, 863. – Average production of a dairy herd, 872. – Influence of epizootic abortion on M. and butter production, 343. – Influence of foot-and-mouth disease on M. and M. production, 639. – Influence of diet and sunlight on vitamine content of M., 342. – Production of M. with Anti-rachitic properties, 95. – Influence of Insulin and Glucose on M. secretion and composition, 330. – Freezing point of Sudan M., 360. – Measurement of Hydrogenion Concentration in dairy products, 358. – Reducing and oxydising reactions in M., 361. – Mammary Microflora, *p.* 65. – Influence of Pasteurization and diet of cow on anti-scorbutic potency of M., 94. – Pasteurization, 641. – *Oidium variicolor*, mould in M. and by-products, 359. – M. industry in Egypt, 366. – In India, *p.* 781. – In Holland, *p.* 389, *p.* 391. – Gerber method for fat-determination in M., 638. – Value of methods in M. testing, 338. – Re accuracy of Milk-record association results, 871. – M. testing of the Salers breed, 610. – Enquiry on dairy cow testing, *p.* 485, *p.* 781. – Causes of variations in Cream tests, 122. – Foundation for study in feeding of dairy cows (Italy), 691. – Dairy Experimental Institute, Reading (England), 171. – Course of instruction for M. testers, Znaim (Czecho-Slovakia) 940. – International Dairy Congress, Paris, 1925, 197. – Paris (May 1925), 950. – Report on International Dairy Congress (U. S. A.), Oct. 1923, 455. – Exhibition of M. and derivatives, São Paulo (Brazil), Oct. 1925, 994. – Use of Whey mixed with insecticide pow-

ders to render them adhesive, 820. – Solubility of milk powder, 123. – Citric acid content of M. powder, 365. – See also: Buffalo – Cow-Milk Products.
Milk Products: Measurement of Hydrion concentration in M P., 358. – *Oidium variicolor*, mould in M. P., 359. – Ozone for sterilization of water used in milk industry, 640. – See also: Butter – Cheese – Kephir – Milk.
Milking: *p.* 76. – Variations and constant relations in quantity of milk, 863. – M. Machines in Austria, 351.
Milling: 31st Congress of M. industry, Paris, Oct., 1924, 206. – Flour regulations in Roumania, 664.
Mimusops bidentata, 226.
Mineralogy: Manual of m., *p.* 409.
Modiola lateritica, *p.* 1170. – *M. malvifolia*, *p.* 1170.
Molasses: experiments on feeding M. to dairy cows, 866.
Mollugo verticillata, *p.* 1103.
"Molungu", shading trees for experimental cocoa plantations in Brazil, 670.
Montrichardia arborescens, 635.
Moors, *p.* 1078.
Morocco: Decree for agricultural and silk industries, 657. – Sale of M. phosphate in 1924, 768. – Improvements in sheep breeding, 875. Native school of agriculture, 680.
"Mukka-mukka" (*Montrichardia arborescens*), 635.
Mule: Heredity, *p.* 982.
Musa spp.: see Banana.
Musanga Smithii, and its value in paper manufacture, 57.
Museums: agricultural m., in Czechoslovakia, 939.
Mustard: cultivation in Holland, *p.* 386.
"Mutarawka" (*Juniperus procera*), 79.
Myricaria, *p.* 333.
NELUMBIUM, *p.* 676.
Neslia paniculata, *p.* 1137, *p.* 1140.
Netherlands: Agriculture, *p.* 386. – Potash, 1036. – Regulations for control and marking of cheese, 662. – Plant protection, 404. – International Committee of phytopathology and economic entomology, 440. – International Cattle-breeding Congress, the Hague, Aug. Sept. 1923, 192. – Catalogue of geological and agro-geological collections of Wageningen Higher school of agriculture, 247. – Periodicals: *Landbouwkundig Tijdschrift*, 257. – *Nederlandsch Weekblad voor Zuivelbereidling en Handel*, 1045.
Nettle-rash, *p.* 336.
New Caledonia: Walpole Island Phosphate deposits, 7.
New Zealand: Stratford Demonstration Farm, 686. – International and South Seas Exhibition, Dunedin, Nov. 1925, 211.
Nickel: present in arable land in various countries, *p.* 1056.
Nicotine in Tobacco, 572, 592. – N. as insecticide, 820.
Nigella spp., *p.* 333. – *N. arvensis*, *p.* 1100.
Nipah Palm: Sugar content of juice, 72.
Nitrates: see Nitrogenous fertilizers.
Nitrogen: amount found in rainfall in Kentucky, 1.
Norway: Soils of Moistad Experiment Station, Hedmark, *p.* 1081.
Nurseries: Tea N., 589. – Nursery-gardening in Holland, *p.* 396.
Nyasaland: see Union of South Africa:

OAK: composition of forest litter, *p.* 407. – Tanning qualities, 604. – Hygienic conditions in Belgium, *p.* 94.
Oats: utilization of solar energy by

O., 563. – Phosphoric-acid content of o., *p.* 937. – Impurities in imported o., *p.* 1139. – Importation of o. for sowing in Luxemburg., 889. – As impurities in seeds from Argentina, *p.* 1169, *p.* 1170. – New variety of o., 834. – Cultivation of o., by spaced-row and and hoeing system, 616. – In experiments with fallow in U.S.A., 619. – In relation to agricultural costs of production, 623. – Cultivation in Rumania, *p.* 348. – In Holland, *p.* 386. – Hygienic conditions in Belgium, *p.* 90. – Utilization of o. hulls for production of Furfural, 107.

Ochroma Lagopus (?) 603.

Ocimum gratissimum, 593.

Oenocarpus distichus, 755.

Oenothera spp., *p.* 333. – *O. heterophylla*, *p.* 1103.

Oil: Olive industry in S. Europe, 354. – Production of vegetable O. in Chile, 60. – New process for removal of Acid from O., 753. – Uniform international analysis methods for O., 503. – Experimental work in Olive cultivation (France), 912. – Cashew nut O., 110. – " Babassù " O., 850. – Brazilian Oil-palms, 755. – Palm O. machinery, 622. – Palm O. in British W. Africa, 1017. – O. extracted from grape seeds, 912. – O. Congress, S. Paulo, Brazil, 960. – *Journal of Oil and Fat Industries*, 527.

Oil Palm: Machinery for O. P., 622. – O. P. in British W. Africa, 1017. – La Mé experimental Station (Ivory Coast), 922. – Pobé experimental station (Dahomey), 923. – Brazilian O. P., 755.

Oil plants: " Babassù ", 226, 755, 850. – *Bertholletia excelsa*, 226. – Coconut palm, 59, 109, 314, 658, 851. – O. palm, 622, 755, 850. – Brazilian O. palms, 755. – Olive, 354, 454. – " Piassava " nuts, 850. – Soybean, 58, 840. – See also: Oil.

Oils (essential): extraction by means of refrigerator plant, 629.

Olive: Experimental work in O. cultivation, (France), 912. – Congress of Italian O. growers, Bari, Oct. 1925, 969. – 7th International Congress of O. growers, Seville, Dec. 1924, 191. – Report on above, 454.

Olive-pickling, 354.

Olive residues in Sheep and Pig feeding, 85.

Onions: cultivation in Holland, *p.* 386. – Marketing of American-grown Bermuda O., 633.

Onobrychis sativa, *p.* 1176.

Opium: Experiments in Spain, 325. – Anti-O. campaign, League of Nations, 752.

Orbignia Martiana, 755, 850.

Ornamental plants: Study of o. p. (U. S. A.), 905.

Ossification, 332.

Osteophagy, *p.* 59.

Ostrich: " Lamziekte " reproduced experimentally on O., *p.* 59.

Ozone: for sterilization of water used in milk industry, 640.

PACKING: Oats imported into Luxemburg, 889. – Seeds of forage plants, in Roumania, 890. – Apple p. Stations in G. Britain, 946. – Silkworm eggs in France, 885.

Palestine: Agricultural conditions, *p.* 751. – Chemical examination of sand from Mediterranean Coast of P., *p.* 736. – Vineyards near Jaffa, *p.* 728. – Afforestation, 241. – Hebrew University of Jerusalem, 933.

Palm-nuts, 850.

Panama: Land settlement, 231. – Model farm at Alanje, Chiriqui Province, 167.

Panicum Bergi, *p.* 1168, *p.* 1169. – *P. capillare*, *p.* 1103, *p.* 1120. – *P. colonum*, *p.* 1168. – *P. Crus-galli*, *p.* 1100, *p.* 1115, *p.* 1117, *p.* 1120. – *P. dichotomiflorum*, *p.* 1103. – *P. Gattingeri*, *p.* 1103. – *P. insulare*, *p.* 1174. – *P. lanuginosum*, *p.* 1103. – *P. miliaceum*, *p.* 1100, *p.* 1117. – *P. parvipulvinatum*, *p.* 1103, *p.* 1125.

Paper : Chief materials used in p. making, 636. - " Tambookie grass " (*Hyperrhenice glauca*), 355. – Timber from British Guiana, 635.

Paraguay : Cotton seed, 663. – School of agriculture at Asunción, 937. – Foundation of Agricultural and Stock-breeding School, 431.

'Paralysis of chickens, due to coccidiosis, 862.

" Parasolier " (*Musanga Smithii*), in paper making, 57.

Parietaria, *p.* 333.

Park : Parco nazionale d'Abruzzo, 948. – Albert National P., Belgian Congo, 508.

Pasciuba " (*Iriartea Orbigniana* and *I. exorrhiza*), 755.

Paspalum setaceum, *p.* 1103.

Passiflora, *p.* 333.

Pasture : Soils of overflow meadows on banks of the Volkhov and Lake Ilmen, *p.* 1083. – Improvement of P. lands in Czechoslovakia, 1019. – Improvement of grassland and p. of mountain communities in Italy, 748. – Improvement of grassland in Yorkshire, England, 55. – Tropical graminae harmful to P. in Belgian Congo, 54. –

Patchouli, 593.

Paullinia Cupana, (Guarana or Varana), 226.

Peach : " Convegno del Pesco ", Canale d'Alba, July 1925, 972. – Hygienic conditions in Belgium, *p.* 93.

Pear : Germination Capacity of the pollen of certain varieties of P., 300. – Hygienic conditions in Belgium, *p.* 93. – Harvesting and Storage of P., 117. – Effects of moist and dry air on the preservation of P., 289.

Peas : Germination, *p.* 1176. – Consumption of oxygen by roots of p., 563. – Content in phosphoric acid, *p.* 937. – Cultivation in Roumania, *p.* 681, *p.* 691 ; in Holland, *p.* 386.

Peat : Formation and general properties, *p.* 158. – Uses of p., *p.* 729. – Partial Sterilisation, *p.* 431. – Availability of nitrogen in P., 273. – P. for the improvement of sandy soil, *p.* 437. – Examination of P. materials, *p.* 1058.

Pedology : see Soil Science.

Pencil Cedar from East Africa, 79.

Pentacme siamensis, 852.

Peony (*Paeonia*) : germination, *p.* 333.

Peplis, *p.* 333.

Perfume plants : Essential oils from various parts of the British Empire, 593. – U. S. A. Research fellowship in chemistry of perfumes and essential oils, 906. – *Cymbopogon giganteum*, 593. – Huon pine, 953. – *Ocimum gratissimum*, 593. – *Salvia spinosa*, 74. – *Tagetes minuta*, 593. – Thyme, 593.

Periodicals : International Congress of Technical Press, Paris, Sept. 1925, 953. – Agricultural : Austria, 1039. – Brazil, 1041. – Dutch E. Indies, 529. – France, 1042. – Germany, 772. – Great Britain, 780. – Guatemala, 256. – Holland, 257. – Italy, 781. – Russia, 258. Spain, 523, 524, 776, 777, 778. – United States, 779. – Scientific, 1043. – Biological Science, 252, 526. – Biological technique, 519. – Chemistry, 259. – Chemistry and Pharmacy, 525. – Chemical laboratory practice, 255. – Colloids,

774. - Soil Science, *p.* 166, *p.* 763. – Botany, 530. – Guano, 782. – Potatoes, 520. – Rubber, 528, 529, 751. – Pomology, 1046. – Forestry, 1040. – Centenary of the Allgemeine Forst- und Jagdzeitung, 521 – Timber, 253. – Aviculture, 1044. – Beekeeping, 775. – Rural engineering and agricultural machines, 254, 522, 773. – Oils and Fats, 527. – Cheese industry, 1045. – Agricultural markets, 1038. – Austria: *Der Landwirt*, 1039. – *Biologia generalis*, 252. – *Centralblatt für das gesamte Forstwesen*, 1040. – *Internationale Holzzeitung*, 253' – *Oesterreichische landw. Marktzeitung*, 1038. – Brazil : *Ceres*, 1041. – China : *China Chemists' and Druggists' Review*, 525, – Dutch E. Indies : *De Indische Culturen*, 529. – France : *Les Fastes de l'Agriculture*, 1042. – *Revue Scientifique*, 1043. – Germany : *Zeitschrift für technische Biologie* 519. – *Die Laboratoriumspraxis*, 255. – *Kolloid Zeitschrift*, 774. – *Deutsche Bergwerks-zeitung*, 773. – "Kartoffelnummer" of the *Deutsche landw. Presse*, 520. – Centenary of the *Allgemeine Forst- und Jagdzeitung*, 521. – *Technik und Wirtschaft*, 522. – *Ratgeber für den Maschinbetrieb in der Landwirtschaft*, 254. – Great Britain : *Agricultural Progress*, 780. – *India Rubber Journal*, 528. – *World's Rubber Position*, 751. – *Feathered World*, 1044. – Guatemala : *Agricultura*, 256. – Holland : *Landbouwkundig Tijdschrift*, 257. – *Nederlandsch Weekblad voor Zuivelbereiding en Handel*, 1045. – Hungary : *Chemische Rundschau für Mitteleuropa und Balkan*, 259. – Italy : National Association of the Agricultural Press, 451. – *Yearbook of the Italian Agricultural Press*, 781. – Peru : *Boletin de la Compañia administradora del guano*, 781. – Russia : *Journal of Experimental agriculture of S. W. Russia*, 258. – *Pédologie*, *p.* 763. – Spain : *Boletín de Agricultura técnica y económica*, 776. – *Progreso Agricola y Pecuario*, 777. – *Vida Agricola*, 778. – *Producción*, 523. – *El crédito agricola* 524. – *La Colmena*, 775. – Sweden : *Sveriges Pomologiska Forenings Arsskrift*, 1046. – United States : *Missouri Yearbook of Agriculture*, 1924, 779. – *International Biological Abstracts*, 526. – *Journal of Oil and Fat Industries*, 527.

Persia : Alkali soils in Iraq, *p.* 753, *p.* 754. – Bardy Reed from Iraq in paper-making, 636. – Locusts in Iraq, *p.* 1182. – Agricultural Exhibition, Teheran, Aug. 1925, 1007.

Personal : 260-267 ; 531-555 ; 783-806 ; 1047-1065 ; *p.* 467 ; *p.* 763, *p.* 764.

Peru : Cotton, 56. – Pan-American Conference on Standardization, Lima, Dec. 1924, 194. – *Boletín de la Compañia administradora del guano*, 782.

"Petits-cocos", 850.

Petrography : Treatise on, *p.* 409. – Petrographic "Vademecum", *p.* 410.

Petroleum : Technical School for the study of P. founded at Strassburg by French Govt., 679.

Phalaris brachystachys, *p.* 1138, *p.* 1139. – *Ph. canariensis*, *p.* 386, *p.* 1169, *p.* 1170. – *Ph. intermedia*, *p.* 1169.

Phaseolus lunatus (Lima bean) : investigation re toxicity, 29. – *Ph. multiflorus*, 573. – *Ph. vulgaris*, 573. – See also : Bean.

Phenology : German Phenological Service maps, 668. – "Karl-Heinz-Thost Foundation" for study of ph., 669.

Philippines : Comparative Tests of

native maize varieties, 575. – Selection in rice fields, in P., 40. – Copra industry and drying-methods, 109.
Phleum pratense : (timothy grass), *p.* 1098, *p.* 1105, *p.* 1110, *p.* 1111, *p.* 1119, *p.* 1126; 380.
Phormium tenax, 842.
Phosphates : see Fertilizers (phosphatic).
Phosphorus in Stock feeding, *p.* 58.
Photinia Benthamiana, 858.
Photoperiodism in relation to Hydrogenion concentration of Cell Sap and Carbohydrate content of Plats, 32.
Photosynthesis, *p.* 329.
Physalis spp., *p.* 1103, *p.* 1120.
Phytelephas macrocarpa, 226, 755.
Phytolacca dioica (Belhambra), 841.
Piassava (*Leopoldinia Piassaba* and *Attalea funifera*) as an oil palm in Brazil, 755. – Exportation of palm nuts, from Brazil, 850.
Pica, 59.
Picea Engelmanni, 31.
Picris echioides, *p.* 1101. – *P. hieracioides*, *p.* 1098. – *P. stricta*, *p.* 1104.
Pigs: Mineral metabolism of the growing P., 346. – Olive residues in feeding, 85. – Feeding experiments with self-feeders, 96. – Breeds of Roumania, *p.* 976. – P. breeding in Tunisia, 611, 1029.
" Pindoba " (*Attalea compta*), 755.
Pine : Transpiration of coniferous tree seedlings, 31. – Quantity and potash composition of needle-fall, *p.* 407, *p.* 408. – Hygienic conditions in Belgium, *p.* 94, *p.* 95.
Pineapple : Manganese Chlorosis of p., its cause and control, 819. – Production of p., 326.
Pinus aristata, 31. – *P. scopulorum*, 31.
Pisciculture : Artificial fertilizing of fishponds, *p.* 677; 878. – Regulations re stewponds at Warsaw Agricultural Congress, 711. – Hydrological research station, Obernachtal, Bavaria, 667.
Pithecolobium trapezifolium, 635.
Plant breeding : see Genetics.
Plant nutrition: Photoperiodism in relation to Hydrogen-ion concentration and carbohydrate content of plants, 32. – Natural increase of metal salts and other inorganic compounds in P., *p.* 438. – Effect of salts on the intake of inorganic elements by P., *p.* 437.
Plant nutrition : Importance to P. of nutritious soil substances with interchangeable bases, *p.* 439. – Photosynthesis, *p.* 329, 330. – Effects of additions of Nitrogen, Phosphorous and Potassium on Nitrogen economy *p.* 438. – Nitrogenous metabolism of the higher P., 826. – Alleged fixation of Nitrogen by green algae, *p.* 438. – Influence of lime on absorbent soil substances, *p.* 439. – Effect of varying supply of n. upon character and composition of maize *p.* 1078. – Absorption of carbon by roots of P., 284. – Feeding power of P. in different soil horizons, 828. – Importance of calcium in p. n., 26. – Studies in transpiration of coniferous tree seedlings, 31. – Daily variation of carbohydrates in leaves of Maize and Sorghums 27. – Starches as a food reserve, 290.
Plant Sociology, *p.* 663. – See also Ecology.
Plantago aristata, *p.* 1103, *p.* 1121. – *Pl. lanceolata*, *p.* 1099, *p.* 1104, *p.* 1110, *p.* 1115, *p.* 1117, *p.* 1119, *p.* 1126, *p.* 1129, *p.* 1134, *p.* 1175. – *Pl. major*, *p.* 1105, *p.* 1127. – *Pl. Rugelii*, *p.* 1103, *p.* 1119, *p.* 1127.
Plough : French competition for most important improvement in the tractor-plough, 1025.

Ploughing: Sub-soiling trials in Oxfordshire, 618. – Mechanical tillage on sugar plantations, 617. - As a method of locust control, *p*. 1184.

Plums: Hygienic conditions in Belgium, *p*. 93. – Economic utilization of p. in brandy distilling with Löschnigs' boiler, 353.

Poa annua, *P. trivialis*, *p*. 1098.

Poinciana, 76.

Poisonous plants for livestock, *p*. 60. – In Belgian Congo, 54.

" Polak " (*Ochroma Lagopus?*), 603.

Poland: Impurities in clover seed, *p*. 1128. - Vistula horse bean, 306. – Beekeeping, 99. – Bibliography of Polish Botany, 530. – National Institute of rural economy, Pulawy, 189. – Internat. Congress of Agriculture, Warsaw, June 1925, 200, 462, 711. – 1st Internat. Conference of Sugarbeet growers, Warsaw, June 1925, 955.

Pollen: Ionolysis, *p*. 11. – Germination capacity of p. of certain kinds of apples and pears 300. – Impollination of apples, 858. – Of cacao, 565.

Polycnemum majus, *p*. 1100, *p*. 1117.

Polygonum aviculare, *p*. 1105, *p*. 1108, *p*. 1115, *p*. 1117, *p*. 1120, *p*. 1129. – *P. campestre*, *p*. 1164. – *P. chilense*, *p*. 1164, *p*. 1166, *p*. 1169. – *P. Convolvulus*, *p*. 1136, *p*. 1167, *p*. 1170. – *P. pensylvanicum*, *p*. 1103. – *P. Persicaria*, *p*. 1104, *p*. 1119, *p*. 1126, *p*. 1170.

Pongamia glabra as an organic manure, 807.

Poppy (*Papaver somniferum*), ionolysis, *p*. 13. – Cultivation in Holland (seed), *p*. 386. - In Spain, (for opium), 325 - Anti-opium campaign, 752.

Porto Rico: New varieties of sugar cane, 248.

Portugal: Re-organisation of the Ministry of Agriculture, 405. – Measures for utilization of waste land, 406. – Science Congress at Coimbra, June 1925, 715.

Potash: see Fertilizers, Potash.

Potato: Studies on P. tuber, 24. - Utilization of solar energy, 563. – Phosphoric-acid content, *p*. 937. – Sources of ammonia in P. fertilizers, 17. – Experiments in acclimatising Scotch P. in Austria, 307. – Seed P. improvement methods in U.S.A., 42. – P. trials in Scotland, 48. – Size of P. sets, 49. – P. sprouts as an index of seed value, 43. - Germination, 568. – Production under irrigation in State of Victoria, 50. – Cost of production, 623. – P. industry in Czechoslovakia, 750. – Cultivation in Holland, *p*. 386. – Effect of feeding P. to dairy cows, 341. – Hygienic conditions in Belgium, *p*. 90. – Control of wart disease of P., by soil treatment and sulphur, *p*. 1061.

Potato-starch: industry in Czechoslovakia, 750.

Potentilla erecta, *p*. 1078.

Poultry Breeding: Treatise on P B., 876. – Improved Incubators, 1032. – Selection of P., and hatching, 877. – P., breeds in Roumania, *p*. 977. – Cross-breeding in first generation in P. B., 90. – Mucous Tissue of Cock's Comb and reaction of Sexual Hormone, 606. – Evolution of Potentialities in Chicks, 612. – Broodiness and Egg-production, 98. – Shape and weight of Eggs in relation to Sex of chicks, 347. – Growth of white Leghorn Chicks, 613. – Effect of cold on Egg germination, 97. – Effect of adding vitamine-rich substance to normal ration, 83. – Locusts in feeding P., 86. – P. B. in Holland, *p*. 390, *p*. 392. – Poultry Diseases: Paralysis of chicks due to cocci-

diosis, 862. – Avian Tuberculosis, 82. – English avicultural Annual, 1044. – Instruction in P. B. in France, 915. – Egg-laying competition at Klosterneuburg (Austria) 348. – Cinematograph in instruction in P. B. in France, 510. – International Federation of Aviculture, 694. – P. B. Society in Algeria, 182. – Third World P. Congress and Exhibition, Canada, 1927, 199, 951. – Proceedings of 2nd World P. Congress, Barcelona, 1924, 957. – International P. Exhibition, Brussels, 1925, 208. – Lyons, 1925, 210. – Lille (« Société des Aviculteurs du Nord »), 1925, 980. – 8th International P. Fair Brussels, 1925, 982.

Preservation of Agricultural Products: Sweet Corn Drying, 120. – Fruit p. technique, 113. – Storage of Apples, 631. – Loss in weight of stored apples, 118. – Storage of apples and pears, 117. – Cold Storage for Table Grapes, 119. – Ethylene in colouring of citrus fruit, 116. – Technology of Canning, 121. – Solubility of milk powder, 123. – See also: Cold Storage. – Ensilage.

Protection of natural features of Lower Austria, 385.

Protozoa of the Soil: see Soil Science.

Pruning: of the Olive, 912, 921. – Long p. of the vine, 327. – P. of the wine by "Maroger" method, *p.* 351.

Prunus Padus, *p.* 332. – *P. spinosa*, *p.* 333.

Psalliota campestris, 634.

Pseudotsuga taxifolia, 31.

Publicity Fair, Leipzig, March 1925, 476.

Pyrethrum flowers in the preparation of insecticides, 820.

QUEENSLAND: See Australia.

Quercus Robur, *Q. Suber*, *p.* 1078.

Quinine: discovery of Alkaloids in, 770.

RACHITIS: R. and deficiency in Vitamines, *p.* 58. – Production of cow's milk with antirachitic properties, 95.

Radiotelephony for diffusion of information on breeding of small livestock in Spain, 509.

Radium: Radioactivity of the eruptive gases of Vesuvius and Solfatara volcanoes, *p.* 327. – Beneficial and injurious effects of short-wave rays in nature, *p.* 331. – Radioactivity and mutation of plant species, *p.* 10. – Antirachitic properties imparted to inert fluids and green vegetables by ultraviolet irradiation, 335.

Rain: Sulphur and Nitrogen in Kentucky rainfall, 1. – Wheat yield and rainfall in Ohio, 2.

Ramie (*Boehmeria nivea*), produced in the British Empire, 842.

Ranunculus spp., *p.* 1175. – *R. acer*, *p.* 1100. – *R. repens*, *p.* 1104, *p.* 1111.

Rape: Anatomy of root and stem formation, 23. – Cost of production, 623. – Cultivation in Holland, *p.* 386.

Raphanus sativus, *p.* 1170.

Raphiolepis indica, 858.

Rapistrum orientale, *p.* 1138, *p.* 1139. – *R. perenne*, *p.* 1138, *p.* 1139. – *R. rugosum*, *p.* 1138, *p.* 1139, *p.* 1170.

"Ray" system of cultivation (forest and brush burning), 590.

Reclamation: see Agricultural Methods – Land Reclamation.

"Reformphosphat", *p.* 922, *p.* 932.

Reseda luteola, *p.* 1098, *p.* 1099.

Resins and Oleo-resins of Indo-China, 852.

Réunion (Isle of): Water and Forestry Service, 703.

Reviews : see Periodicals.
Rhenania phosphate, 281 ; *p.* 922.
Rhus Coriaria, 61.
Rice : Weed seeds of r., from Argentina, *p.* 1170. – Fertilizing, 46. – Effect of manganese on growth and yield of r., 818. – Improvement of r. varieties in Ceylon, 837. – Foreign varieties of r., introduced into China, 900. – Mass selection in Philippine r. fields, 40. – Machine winnowing of r. seed, 576. – Systems of cultivation, *p.* 669. – Cultivation without transplanting, 350. – R. growing in Brazil, 1011 ; in Ceylon, 45 ; in Malaya, 47. – Control of r. trade, Ivory Coast, 886.
Robinia Pseudo-Acacia, *p.* 329.
Rontgen Rays and fruit examination, 244.
Röots : Contrivance for studying development of r., 21. – Structure and identification of r. of certain fruit trees, 22. – Anatomy of r. of rape and turnip, 23. – Thermotropism, 283. – Absorption of carbon by r., 284. – Oxygen and r. of plants, 563. – Relation of r. growth to oxygen supply, 30.
Rose : International R. Show, Bagatelle (Bois de Boulogne) 1925 – 1926, 484.
" Rougier ", red Permian soil, dep. of Aveyron (France), *p.* 1071.
Roumania : Agrarian policy and Agricultural production, 501. – Development of agriculture as a result of agricultural reforms, 1018. – Institution of agricultural Chambers, 892. – Cereal crops and trade, *p.* 338, *p.* 1004. – New wheat, flour and bread regulations, 664, 891. – Cultivation of leguminous seed crops, *p.* 680. – Testing of seeds of forage plants, 890. – Impurities in red clover seed, *p.* 1129. – Vine-growing, *p.* 35. – Stockbreeding, *p.* 972. – Damage caused by Golubatz Fly, 329. – Measures for encouragement of sericulture, 149. – International Congress of pure and applied chemistry, Bucharest, June 1925, 954.
Rubber : World's r. position, 751. – R. in Brazil, 1011. – Control of r. on Ivory Coast, 886. – International Conference on Tropical R. products, Brussels, April 1924, 193.
Rubber plants : Balata (*Mimusops bidentata*), 226. – *Hevea brasiliensis*, 62, 63, 64, 65, 66, 316, 356, 426, 432, 528.
Rubus, *p.* 1152, *p.* 1154.
Rudbeckia hirta, *p.* 1103.
Rumex spp., *p.* 1171. – *R. Acetosa*, *p.* 1115. – *R. Acetosella*, *p.* 1105, *p.* 1111, *p.* 1115, *p.* 1175. – *R. crispus*, *p.* 1104, *p.* 1108, *p.* 1110, *p.* 1118, *p.* 1119, *p.* 1126, *p.* 1129. – *R. domesticus*, *p.* 1100, *p.* 1111. – *R. magellanicus*, *p.* 1165, *p.* 1168. – *R. obtusifolius*, *p.* 1120. – *R. salicifolius*, *p.* 1103. – *R. stenophyllus*, *p.* 1102, *p.* 1117.
Rural Economics : Properties of Soil and their improvement as a basis for Farming Scheme, *p.* 730. – Profit yielding capacity of farms, 626. – Agricultural Valuations, 625. – Importance of Root cultivation in Farming organisation, 623. – Tropical Estate accountancy, 352. – Cost of transport in Africa, 628. – Japanese legislation on Agricultural Tenancy Arbitration, 402. – Calculating average production of Dairy Herd, 872. – United States International Institute of Co-operation, 441. – Brazilian Enquiry re Increase of Prices, 759. – Home Colonization in Italy, 500. – R. e. in Holland, *p.* 392. – Farm organisation in Kansas, 624. – International Congress of Social Eco-

nomy, Buenos Aires, Oct. 1924, 712. – See also: Agriculture in different countries.

Russia: Agricultural progress, 749. – Genesis and geography of agricultural land, *p.* 160. – Soil of R. and surrounding regions, *p.* 749. – Nature of rocks and soil in the Kursk district, *p.* 746. – Soil strata in White R., *p.* 441; in Ukraine, *p.* 442. – Soils on Banks of the Volkhov and Lake Ilmen, *p.* 1083. – Tobacco Cultivation in Ukraine, *p.* 538. – Vine-growing and wine-making, *p.* 17. – Vine-growing districts, *p.* 357. – Requirements in agricultural machinery and implements, 502. – Cold Storage organisation, 190. – New theory of solutions (work of the Chair of Scientific research, Kiev, Ukraine), *p.* 1. - Technical chemical Bureau of the Russian Sugar-refining Union Kiev, 452. – Ukraine Committee for Scientific agriculture, 453. – Periodicals: *Journal of Experimental Agriculture of South-Western Russia,* 258. – *Pédologie, p.* 763.

Rye: Utilisation of solar energy, 563. – Assimilation of Potash by r. seedlings, 386. – Cultivation by spaced-row and hoeing system, 616. – Cultivation in Brazil, 1011. - In Holland, *p.* 086. – In Rumania, *p.* 349. – Hygienic conditions in Belgium, *p.* 90.

Rye grass (*Lolium* spp.): Weed seeds of *Lolium multiflorum* from Argentina, *p.* 1170. – Admixture of annual Argentine r. g. seed in English and Italian r. g. seed, *p.* 1176.

SAINFOIN: Germination problems, *p.* 1176.

Salsola Kali, p. 1102, *p.* 1118. – *S. pestifer, p.* 1103.

Salt as fertilizer, 817.

Salvia nemorosa, p. 1101. – *S. pratensis, p.* 1098. – *S. Sclarea,* 74. – *S. spinosa,* 74.

San Salvador: Measures for the encouragement of agriculture, 150.

Saponaria Vaccaria, p. 1138, *p.* 1139.

" Sapucaia " (*Bertholletia excelsa*), 226.

Sarothamnus scoparium, p. 332.

" Savarts ", *p.* 663.

Schefflera depressa, 635.

Scleranthus annuus, p. 1099.

Scurvy: Isolation of the Antiscorbutic factor, 294. – Antiscorbutic potency of milk, 94.

Sea weeds: see Algae.

Sedum acre, p. 333.

Seeds: International Seed testing association: papers, *p.* 1095, *p.* 1134, *p.* 1163; abstracts, *p.* 1173; general information, *p.* 1177. – Members of the Int. S. t. Assoc., *p.* 1177. – Note re corresponding members, *p.* 1181. – Determination of place of origin of S., *p.* 1134. – Determination of place of origin of clover and forage crop S., *p.* 1095, *p.* 1141. – Place of origin of S. from Argentina determined from accompanying weed seeds, *p.* 1163. – Uniformity in S. testing reports, *p.* 1173. – Determination of moisture in S., *p.* 1174. – Grading of S. and purity; what species are to be described as weeds ?, *p.* 1174. Report of the Dodder Committee, *p.* 1175. – Work of Official Seed testing Station for England and Wales, *p.* 1175. – Vitality of buried S., *p.* 1176. - Effects of short-wave irradiation on germination, *p.* 331. – " Verdissage " of S., *p.* 236. – Spacing experiments, 620. – " Yeoman II " a new seed wheat, 239. – Importation into Luxemburg of oats for sowing, 889. – Seed maize improvement, 41. – Effect of high temperatures on germination and growth of maize, 301. – Machine

winnowing of rice s., 576. – Argentine Rye Grass s. and Italian Rye grass s., *p.* 1176. – Agricultural value of trefoil and influence of origin of seed, 52. – Effects of dry heat on Alfalfa s., 577. – Seed inoculation of lucerne, *p.* 1076. – Seed potato improvement methods in U.S.A., 42. – Potato trials in Scotland, 48. – Size of potato sets, 49. – Potato sprouts as index of S. value, 43. – Factors affecting protein and oil content of soybeans, 58. – Disinfection of cotton s. with Carbon disulphide, 302. – Distribution of cotton s. in different States of Brazil, 497. – Cotton s. in Paraguay, 663. – Community cotton production and pure seed supply, U.S.A., 498. – Improvement of Queensland Cotton S., 845. – Tea s. production in Tranninh (Upper Laos), 590. – Cacao s., 565. – Selection of seed coconuts, 851. – Standardisation of methods of analysis of S., 711. – Brazil : Govermmet s. service, 943. – S. farm, São Simão, Brazil, 444. – Regional S. competitions, Brazil, 478. – Chile : regulations for Advances of S., 882. – S. selection in Czechoslovakia, 750. – Regulation of trade in cereal S., France, 655. – Production of pure s. (Italy), 688. – Production of S. for sowing (Latvia), 147. – Fund for S. (Latvia), 888. – S. production in Holland, *p.* 386. – Experimental work with S. in Tanganyika Territory, 424. – S. selection in Kingdom of Serbs, Croats and Slovenes, 151. – Testing of S. of forage plants in Roumania, 890. – International S. exchange by botanic gardens, 675. – Federal experimental S. testing Institute, Lausanne, 435. Reports of 1st International S. trade Congress, London, July 1924, 458. – National S. Fair, Paris, Jan. 1925, 218, 486.

" Segala " (rye soil ") in dept. of Aveyron, France, *p.* 1071.

Serbs-Croats and Slovenes (Kingdom of) : Seed selection, 151. – Viticulture, 151.

Sericulture : Work of Prof. Lenticchia, 798. – Silk producing Lepidoptera in French Guinea, 100. – Barbacena sericultural Station, Brazil, 898. – Protection of S. in State of São Paulo, Brazil, 387. – Experiments in S. (France), 916. – Supervision of production of silkworm eggs (France), 885. – Diploma of expert producer of silkworm seed (France), 917. – Supervision of preparation of silkworm seed (Italy), 400. – Regulation of S. Madagascar, 145. – Decree in favour of S. in Morocco, 657. – In Roumannia, 149. – International Silk Congress, Paris, June 1925, 956.

Serodiagnostic investigations on affinity between various Dicotyledons, 20.

Setaria spp., *p.* 1139. – *S. germanica*, *p.* 1100, *p.* 1117. – *S. glauca*, *p.* 1100, *p.* 1104, *p.* 1115, *p.* 1118, *p.* 1119, *p.* 1126. – *S. imberbis*, *p.* 1168, *p.* 1169. – *S. viridis*, *p.* 1100, *p.* 1104, *p.* 1115, *p.* 1117, *p.* 1119.

Sexual hormones, 606.

Seychelles : Cinnamon oil from S., 593.

Sheep : Olive residues in S. feeding, 85. – Breeds in Roumania, *p.* 975. – Breeding of Merinos in Haute-Volta, (French W. Africa), 887. – Lagrenée breed in Tunis, 344. – Improvements in S. breeding in Morocco, 875. – " Lamziekte ", *p.* 59. – Vocational school for shepherds, Rambouillet, France, 168. – International S. show, Montevideo, Uruguay, Feb. 1924, 213.

Sherardia arvensis, *p*. 1099, *p*. 1104, *p*. 1105, *p*. 1175.
Shorea cambodiana, *Sh. cochinchinensis*, *Sh. Harmandii*, *Sh. Henriana*, *Sh. hypochra*, *Sh. maritima*, *Sh. Thorelli*, *Sh. obtusa*, *Sh. siamensis*, *Sh. vulgaris*, 852.
Shows : see Exhibitions.
Sida rhombifolia, *p*. 1170.
Sierra Leone : see British West Africa.
Silage : S. feeding investigations, 84, 111.
" Silani " (*Vigna marina*), cover and forage crop, in the Philippines, 579.
Silene antirrhina, *p*, 1103. – *S. dichotoma*, *p*. 1098, *p*. 1102, *p*. 1115. – *S. gallica*, *p*. 1170. – *S. inflata*, *p*. 1099, *p*. 1130.
Silo (Italian method), in U.S.A., 238.
Silybum Marianum, *p*. 1170.
Simulium columbaczense (Golubatz Fly), 329.
Sinapis arvensis, *p*. 1104, *p*. 1105, *p*. 1108, *p*. 1118, *p*. 1130, *p*. 1136, *p*. 1175.
Sindora cochinchinensis, 852.
Sinter-phosphate, *p*. 922.
Sisal : Production and characteristics 585. – Production in British Empire, 842. – On the Gold Coast, 313. Cultivation of S. encouraged in Martinique, 658. – Cultivation in Malaya, 584.
Sisyrinchium spp., *p*. 1103.
Slaughter-House Blood in Animal feeding, 87.
Soil correction : Importance of Calcium for plants, 26. – Fertilizer tests with and without ground Limestone, 556. – Synthetic Calcium Silicate as a Source of Lime for Soils, 271. – Hydrogenion Concentration in S. and Lime requirement, *p*. 142. – Soluble Calcium, of S., in relation to Acidity, *p*. 1059. – Continued applications of Calcium and Magnesium and S. reaction, 270. – S. reaction in relation to Calcium adsorption, *p*. 141 – Effects of Lime on decomposition of S. organic matter, *p*. 428. – Effect of Lime on fertilizing action of Nitrogen, 15. – Chemico-physical effects of Lime and Calcium Carbonates on S., 269. – Transformation of Lime in S., *p*. 741. – Liming of S. in France, *p*. 1064. – Liming of S. in Assam, 4. – Injurious effect of excessive liming on Podsol Soils, *p*. 1061. – Removal of Lime from S., *p*. 1058. – Correction of Sandy Soil with meadow marl, moor and Clay Soils, *p*. 437. – Gypsum : Analysis and products, 5.
Soil Improvement : Hydraulics and s. i., 101. – S. i. in Austria, 443. – In Canada, 947. – In Italy, 763. – Laws re s. i., in Italy, 660. – Associations for s. i., in Southern Italy and the Italian islands, 706. – National Land Improvement Exhibition, Naples, Aug. 1925 1006. – Union of S. Africa Drought Commission (report), 709. – Fertilising of Ponds, 878.
Soil Science : *General* : Manuals on geology, *p*. 410, *p*. 729. – Chart of occurrence of Potassic salts and Petroleum in Germany, *p*. 410. – Manual on Mineralogy, *p*. 409. – Manual on Petrography, *p*. 409. – Petrographic " Vademecum ", *p*. 410. – S. Sc. for Farmers and Foresters, *p*. 410. – S. Sc. for Surveyors and Agricultural Technicians, *p*. 730. – S. morphology and agricultural Sc., *p*. 729. - Subsoil dynamiting, *p*. 731. – Properties of S. and improvement as a basis for a general farming Scheme, *p*. 730. – Peat and its applications, *p*. 729. – Desert climate and animal life, *p*. 728. – U.S.A. national Institute for colloid research, 179.

– Catalogue of geological and agro-geological collections of Wageningen Higher School of Agriculture (Holland), 247. – Literature : *p.* 164 ; *p.* 448 ; *p.* 755 ; *p.* 1087. – *Soil physics* : Decomposition of clay silicates, *p.* 140. – Temperature of the surface of deserts, *p.* 731. – S. shrinkage, *p.* 138. – Influence of barometric pressure changes on aeration of S., *p.* 133. – Radio-activity of eruptive gas of Mt. Vesuvius and Solfatara ; their influence on development of bacteria and higher vegetation, *p.* 327. – Rate of outflow of Granular substances, *p.* 137. – Permeability of Colloid-dispersing substances under influence of electrolytes, *p.* 138. – Alkali S. and Colloidal phenomena, *p.* 139. – Maximum Water-retaining capacity of colloidal S., *p.* 412. – International comparative analyses of S. samples (for mechanical analysis), *p.* 460. – Theory of mechanical analysis of sediments by automatic balance, *p.* 136. – Methods of mechanical analysis of S., *p.* 705. – Form of mechanical composition curves of S., Clays and other granular substances, *p.* 414. – Apparatus for S. volume determination, *p.* 100. – Erosion and surface run-off under different S. conditions, *p.* 1055. – Influence of Water on S. granulation, *p.* 411. – S. moisture investigation methods, *p.* 1055. – Method for directly estimating Water-supplying power of S. in a field, *p.* 412. – Movement of S. Salts and S. moisture determination, *p.* 411. – Moisture equivalent of heavy S., *p.* 413. – Observations on inhibitional s. moisture, *p.* 134. – Capillary distribution of moisture in S. columns, *p.* 135. – Capillary rise in S., *p.* 732. – S. moisture investigations in Canada, *p.* 413. – S. and Subsoil permeability ; evaporation, 563. – Factors influencing S. impermeability, *p.* 1054. – Apparatus for determination of S. permeability, *p.* 733. – Literature : *p.* 164, *p.* 448, *p.* 755, *p.* 1087. – *Soil Chemistry* : Changes in chemical composition of S. after long-continued treatment, *p.* 144. – Studies on virgin and depleted S., *p.* 148. – Chemical decomposition in Egyptian deserts, *p.* 733. – Method for testing artificial fertilizers, *p.* 428. – Examination of Peat materials, *p.* 1058. – S. solutions ; methods for obtaining and testing, *p.* 416. – Secular and seasonal changes in S. solutions, *p.* 415. – Changes in S. solutions on various ploughed fallow S., *p.* 427. – Comparison of S. solution and water extract of Alkali S., *p.* 145. – S. extracts and effect of fertilizer salts, *p.* 423. – Electrical conductivity of S. extracts and detection of infertility, *p.* 147. – Drying of S. and maintainance of fertility, *p.* 420. – Electrical charge of clay colloids, *p.* 416. – Soil colloids and their action on Lime and Bicarbonate of Lime, *p.* 427. – Reactions between S. and various chemical compounds, *p.* 424. – Lime-content and reaction of S. in relation to geological formation, *p.* 1018. – KCl addition in the case of electrometric determination of S. reaction, *p.* 1011. – Easily soluble calcium of S. in relation to Acidity, *p.* 1059. – Cause and nature of lime transformation in S., *p.* 741. – S. reaction in relation to Calcium adsorption, *p.* 141. – Injurious effect of excessive liming of Podsol-S., *p.* 1061. – Liming of S. in France, *p.* 1064. – Removal of lime from S., *p.* 1058. – Adsorp-

tion and absorption of bases by S., *p.* 420. – Base exchange in Rothamsted S, *p.* 740. – Comparison of Qualitative tests for S. acidity, *p.* 417. – Methods of Studying S., a., *p.* 427. – Electrometric determination of S. reaction, *p.* 739, *p.* 740. – Active bases and excess acids in Mineral S. *p.* 425. – Influence of various Salts on acid S., *p.* 421. – Base exchange in relation to S. acidity, *p.* 740. – Importance of hydrogen-ion concentration in physico-chemical studies of S., *p.* 143. – Measurement of hydrogen-ion concentration in S. by quinhydrone electrode, *p.* 142. – Determination of hydrogen-ion concentration of S. by colorimetric method, *p.* 422. – Hydrogen-ion Concentration in S. and lime requirement, *p.* 142. – Relation between P_H value, lime requirement, and thiocyanate colour of S., *p.* 741. – S. acidity and its relation to Nitrate and Ammonia production, *p.* 736. – Acidity of Forest soils, *p.* 738. – Absolute capacity for Air and degree of acidity of forest s., *p.* 1061. – Influence of S. " Buffer action ", *p.* 417. – Alkali Soils: Internat. Society of S. Sc., Sub-committee for Alkali S., *p.* 464. – Investigations on A. S., and colloidal phenomena, *p.* 139. – Chemical and biological effects of treatments on A. S., *p.* 419. – Influence of neutral Salts on S. reaction, *p.* 123. – Nickel and Cobalt in arable S., *p.* 1056. – Iron, Aluminium and Manganese in Hawaiian S. *p.* 147. – Effect of iodine on S. and plants, *p.* 736. – Catalytic action of S., in Moravia, *p.* 105. – Effects of lime on decomposition of S. organic matter, *p.* 428. – Decomposition of organic matter in S., *p.* 426. – S. organic matter and accessory substances promoting plant growth, *p.* 148. – Formation and decomposition of humus, *p.* 733. – Quantity and nature of " Black Substance " in certain Moravian S., *p.* 742. – S. nitrogen, *p.* 422. – Chemical analysis of agricultural S., *p.* 737. – Analysis of Quaternary alluvial deposits, *p.* 1058. – Composition of brick earth, *p.* 1059. – Chemical nature of a colloidal clay, *p.* 1057. – Chemical examination of sand from coast of Palestine, *p.* 736. – Determination of ammonia in S., *p.* 415. –Determination of nitrates in S., *p.* 146. – Determination of Phosphoric Acid, *p.* 1057. – Rapid determination of available phosphate in S. by the Coeruleo-Molybdate reaction of Denigès, *p.* 145. – Composition of S., in relation to deficiency diseases of livestock, *p.* 60. – S. treatment with Sulphur for control of potato wart disease, *p.* 1061. – Soil rocks and their stratification in the Speier chart and on soils of the Kusel chart of the 1 : 100 000 Bavarian geological map, *p.* 142. – Literature: *p.* 164, *p.* 449, *p.* 756, *p.* 1088. – *S. Biology*: Quantities of carbon dioxide formed in S., *p.* 925. – Committee for S. bacteriology, *p.* 465. – Microbic flora in S., *p.* 150. – The Streptotriceae of Vesuvian Soils, *p.* 433. – *Bacillus botulinus* and *B. tetani* in S. samples, *p.* 151. – *Thiobacillus thiooxidans*, *p.* 1076. – Invertebrate fauna of arable land, *p.* 1075. – S. protozoa and their effect on crops, *p.* 151. – Protozoa and S. fertility, *p.* 743. – Protozoan fauna of S. in U.S.A., *p.* 429. – Some Protozoa from S. collected by " Quest " expedition (1921-1922), *p.* 434. – Protozoa from S. and mosses of Spitzbergen, *p.* 743.

– S. analysis by means of Bacteria, *p.* 742. – Quantitative investigation of bacterial and protozoan fauna of S., *p.* 430. – Standardised Agar medium for counting S. bacteria, *p.* 434. – Organic matter and development of micro-organisms in S., *p.* 149. – Partial sterilisation of S., *p.* 151; P. s. of S. by antiseptics, *p.* 154, *p.* 743. – Partial sterilisation of peat, *p.* 431. – Action of Protozoa on bacteria when inoculated into sterile s., *p.* 429. – Investigations on Azotobacter, *p.* 432. – Nitrogen fixation in S. and mannite decomposition, *p.* 150. – Bacteria which fix Nitrogen in Vesuvian S., *p.* 743. – Nitrification in S. African S., *p.* 431. – Influence of nitrifying bacteria on growth of barley, *p.* 431. – Bacterial inoculation of Sugar Beet, *p.* 1074. – Seed inoculation of lucerne (*Medicago sativa*), *p.* 1076. – Ammonification and nitrification of woodland S., *p.* 436. – Deficiency in Nitrate and injury to plants caused by mixing saw-dust with S., *p.* 435, *p.* 440. – Density of unicellular organisms, *p.* 429. – Microbiological course at Pasteur Institute, Paris, 169. – Literature: *p.* 164, *p.* 450, *p.* 757. – *Soil and vegetation*: Appeal for cooperation in work of VI Commission on application of S. Sc. to Scientific Agriculture, *p.* 1092. – S. cultivation and national farming, *p.* 156. – Biogeographical classification of cropping systems, *p.* 663. – S. reaction and yield, *p.* 435. – The concentration of Hydrogen-ions of the S. and formation of plant substances, *p.* 1077. – Factors affecting the growth of crops on acid soils, *p.* 154. – Improvement of sandy s., *p.* 437. – Effect of S. alkali on plant growth, *p.* 745. – Importance to plants of nutritious S. substances with interchangeable bases and influence of Lime on absorbent S. substances, *p.* 439. – Effect of salts on intake of inorganic elements by plants, *p.* 437. – Feeding power of plants in different S. horizons, 828. – Effects of additions of Nitrogen, Phosphorous and Potassium on Nitrogen economy, *p.* 438. – S. organic matter and accessory substances promoting plant growth, *p.* 148. – Deficiency in nitrates caused by woodwaste in S., *p.* 435; injury to plants caused by mixing saw-dust with S., *p.* 440. – Ammonification and nitrification of woodland S., *p.* 436. – Utility of stable manure nitrogen in field S., *p.* 435. – Alleged fixation of nitrogen by green algae, *p.* 438. – S. moisture and available nitrogen in relation to yield of wheat, *p.* 439. – Tropical graminae harmful to pastures and arable land, 54. – Effect of varying supply of nutrients upon character and composition of maize, *p.* 1078. – Injurious after-effects of sorghum, *p.* 155. – Comparative value of alfalfa and sweet clover on S., *p.* 1079. – Forestry value of of sandy S., *p.* 744. – Influence of S. acidity on growth of trees, *p.* 744. – Mortality of firs in the Wienerwald, *p.* 155. – Weed control and moisture conservation, *p.* 746. – Evolution of botanical agronomical formations in W. Congo, 19. – Literature: *p.* 164, *p.* 451, *p.* 757, *p.* 1089. – *Regional S. Sc.*: Origin of Alkali S. and physical effects of treatment, *p.* 157. – Formation and origin of Loess, *p.* 158. – Peat: its properties and formation *p.* 158. – Desert formation, *p.* 158 – Geology of the Sarthe, *p.* 1084. – G. of Pays de Gex (Ain),

p. 1082. – Geology of Istria, *p*. 1080. – G. of Monte Pisano, *p*. 446. – G. to the east of the Catria range, *p*. 446. – G. of Apulia, 935. – Sicilian red earth, *p*. 1081. – Italian forest S., *p*. 163. – Bavarian geological map and S. minerals, *p*. 142. – Agronomical and scientific examination of S. in Welwarn district (Bohemia), *p*. 750. – " Black Substance " in certain Moravian S., *p*. 742. – S. in the Drina-Save-Morava areas, *p*. 751. – Beetroot S. in Bohemia, *p*. 1083. – Brown earth in Finland, *p*. 402. – Chalk in Lettonia, *p*. 750. - S. of Lettonia, *p*. 752. – S. of Moistad Experiment Station, Hedmark, Norway, *p*. 1081. - Genesis and Geography of Russian agricultural land, *p*. 160. – S. of Russia and surrounding regions, *p*. 749. – Rocks and S. in the Kursk district (Russia), *p*. 746. – S. strata in White Russia, *p*. 441; in Ukraine, *p*. 442. – S. in Georgia, *p*. 1085. – S. of overflow meadows on banks of the Volkhov and Lake Ilmen, *p*. 1083. – S. in the Sudan, *p*. 441. – Agricultural conditions in Palestine, *p*. 751. – Alkali S. in Iraq, *p*. 753; *p*. 754. – S. survey of the Dialah Area (Mesopotamia) *p*. 753. – Black cotton s. in Madras Presidency, 849. – S. types in Java and Sumatra, *p*. 164. – Agricultural regions of North Dakota, *p*. 1085. – Iron, Aluminium and Manganese in Hawaiian S., *p*. 147. – Literature: *p*. 164, *p*. 453, *p*. 758, *p*. 1089. – *Nomenclature, Classification and Mapping*: Classification of S. on the basis of analogous series in S. formation, *p*. 1036. – Importance of S. maps in agriculture, *p*. 440. – S. mapping *p*. 440. – Kopecky's scale for S. classification by mechanical analysis, *p*. 121. – Geological observations on ancient soils of Mt. Pisano, *p*. 446. – S. to the east of the Catria range, *p*. 446. – Bavarian geological map, *p*. 142. – Chart of the occurrence of Potassic salts and Petroleum in Germany, *p*. *p*. 410. – Synoptic agropedological map of the Czechoslovakian Republic, *p*. 440. – Construction of a pedological atlas of Poland, 189. – Brown earth in Finland, *p*. 402. – S. of White Russia, *p*. 441; of Ukraine, *p*. 442. – S. in the Sudan, *p*. 441. – Literature: *p*. 164, *p*. 451, *p*. 758, *p*. 1089. – *International Society of S. Sc.*, Rules, *p*. 454. – General notices, *p*. 166, *p*. 454, *p*. 759, *p*. 1090. – Circulars, *p*. 460, *p*. 463, *p*. 760, *p*. 1092. – Commissions, *p*. 760. – I. Committee for Study of S. mechanics and Physics, *p*. 459. – II. Committee for Chemical S. analysis, *p*. 461, *p*. 463, *p*. 761. – Sub-Committee for Alkali S. of the Inter. Soc. of S. Sc., *p*. 464. – III. Committee for S. bacteriology, *p*. 465. – IV. Committee for Study of S. Fertility, *p*. 465. – V. Committee for nomenclature, classification and mapping of S., *p*. 465. – Work of Committee for Agro-geological map of Europe, 1924, *p*. 466, *p*. 762. – VI. Committee for the application of S. Sc. to Scientific agriculture, *p*. 467, *p*. 1092. – " International Reports on S. Sc., " *p*. 166. – Journal " Pédologie ", *p*. 763. – Personal, *p*. 763, *p*. 764.

Solanum carolinense, *p*. 1103. – *S. nigrum*, *p*. 1118.

Solfatara: Radio-activity, *p*. 327

Solutions (new theory of), *p*. 1.

Somalia: possible profitable cultivation of sugar-cane, 245. – Measures for control of plant diseases in Italian S., 661.

Sorghum: Daily variations of Carbo-

hydrates in leaves of S, 27. – Experiments in seed selection with S. in Italy, 688. – Injurious after-effects of S., *p.* 155. – Effect of Nitrate upon Hydrocyanic-acid content of S., 569.

Soya: Factors affecting Protein and Oil content of S., 58. – Time of harvesting for hay and seed, 840.

Spain: Marine fertilisers in Galicia 274. – Dry soil cultivation (new methods), 349. – Tobacco cultivation, 390. – Opium experiments, 325. – Sumac (*Rhus Coriaria*), 61. – Measures for reafforestation, 391. – Regulations re tree felling, 652. – Regulations re Wines and Alcohol, 653. – Protection of forests, 651. – Organisation of Agricultural and Zootechnical Services, 389. – Regulations for remount stations for horses, 393. – Goat-keeping in Malaga, 345. – Olive oil industry, 354. – Customs dues on farm tractors and motors, 392. – Protection of insectivorous birds, 394. – Anti-Malarial prophylaxis, 395. – Popular agricultural instruction at Madrid, 158. – Agricultural fields attached to National Schools, 671. – Intensive course in Viticulture at Pamplona, 414. – Radiotelephony for diffusion of information re small live-stock breeding, 509. – Catalogue of plants in garden of acclimatization, Orotaba, (Canary Isles), 235. – Congress of Vine-growers, Valencia, Nov. 1924, 470. – IV National irrigation congress, Barcelona, May 1925, 469. – VII International Congress of olive growers, Seville, Dec. 1924, 191; Report, 454. – Oil conference, Madrid, Nov. 1924, 471. – Proceedings of II World Poultry Congress, Barcelona, March 1924, 957. – Internat. Sample Fair, Barcelona, Spring 1925, 209. – Periodicals: *Boletin de Agricultura técnica y ecónomica*, 776. – *El Progreso Agricola y Pecuario*, 777. – *La Vida agricola*, 778. – *La Producción* 523. – *El Crédito agricola*, 524. – *La Colmena*, 775.

Spartium junceum, *p.* 329, *p.* 332.

Spergula arvensis, *p.* 1104, *p.* 1111.

Sphacele hastata, *p.* 1168.

Spinach: Spinacin, a new protein from S. leaves, 292.

Spitzbergen: Protozoa from Soils and mosses of S., *p.* 743.

Spondias lutea, 635.

Sporobolus clandestinus, *p.* 1103. – *S. cryptandrus*, *p.* 1103. – *S. neglectus*, *p.* 1103.

Spruce: Amount of needle-fall and of their ashes, *p.* 407. – Hygienic condition in Belgium, *p.* 95.

Stables: Disinfection, 861.

Stachys annua, *p.* 1100, *p.* 1117, *p.* 1130.

Standardization: Pan-American Conference on S., Lima (Peru), Dec. 1924, 194. - St. of cotton, 498, 506.

Starches: as Food Reserve, 290. – S. from Babassù palm, 850. – S. from *Canna edulis*, 839.

Stellaria media, *p.* 1105, *p.* 1175. – *S. palustris*, *p.* 1100.

Sterilization: Partial S. of the Soil, *p.* 151, *p.* 154, *p.* 743. – Partial S., of Peat, *p.* 431. – S. of water used in the Milk industry, 640.

Stewponds: Fertilization, 878.

Stick-lac in Cambodia, 317.

Stipa, 564. – *S. pennata*, *p.* 161.

Stock Breeding: see Genetics (Animal).

Stock Feeding: Nutritive value of phosphorus in S. F., *p.* 58. – Experiments in S. f., at Stockbreeding centre of Clos-Ry (Nièvre), France, 869. – Volume of ration 868. – Silage feeding investigations, 84. – Food value and economy of ensilage for S. f., 111. – Influence

of different oil-cakes on fat-content of milk, 93. – Vine shoots used for S. f., 607. – Olive residues in Sheep and Pig feeding, 85. – Effect of Cane Molasses on digestibility of complete ration for dairy cows, 866. – Yeast as supplementary food for dairy cows, 867 – Slaughter-house blood in S. f., 607. – Locusts in S. f., 86. – Feeding experiments with dairy cows, 873. – See also: Hay, Fodder, Ensilage, Trough, and names of different animals.

Stock Raising: Absence of s. r. and cultivation, *p.* 665. – Animal life in deserts, *p.* 728. – *Belgium*: agricultural and stock-breeding syndicates, 942. – *Bulgaria*: New S. r. station at Chiiakovo, 899. – S. r. exhibition at Razgrade, 1925, 995. – *Esthonia*: Importation of live cattle and animal products, 883. – *Great Britain*: Scottish experimental Stock farm, 925. – *Netherlands*: *p.* 389. – *Poland*: 462, 711. – *Roumania*: *p.* 972. – Pastoral and agricultural exhibition at Jaguarão, Rio Grande do Sul, 1924, 217. – S. r. School in Para, 431. – In Poland, 189. – S. r. and veterinary hygiene Congress in Mexico, 727. – 5th National s. r. competition at Madrid, may 1926, 480. - S. r. competition at Milan Fair, 1925, 223. – S. r. competition at Xeres de la Frontera, 481.

Straits Settlements: Work of the Department of Agriculture, 184.

Strawberry: Hygienic conditions in Belgium, *p.* 92.

Strebius asper, 852.

Streptococci (mammary streptococci), *p.* 67.

" Styfsiekte ", *p.* 63.

Suaeda divaricata, *p.* 1168.

Sudan: Composition of some soils, *p.* 441. – Cotton growing in relation to climate in S., 847. – Cotton grading, 844. – Development of cotton growing in Anglo-Egyptian S., 745.

Sugar: S. cane industry, 245. – Requirements for S. production, 318. – Theory of crystallisation, *p.* 1. – S. beet: production, 1031. – By-products of S. beet, 630. – Recovery of potash from Steffan Waste water, 560. – Control of mould in stored S., 903. – S. industry in Brazil, 1011. – S. beet in Great Britain, 761 – Instructional and experimental S. factory, Trinidad, 685. – Technical chemical bureau of Russian S. refining Union, Kiev, 452. – National Congress of S. and alcohol industries, Ferrara, Italy, May 1925, 975. – See also: Sugar Beet – Sugar Cane – Sugar Palm.

Sugar Beet: from field to factory (Treatise) 1031. – Utilization of solar energy, 563. – Relation between structure and chemical nature of s. b., 825. – Beetroot soils in Bohemia, *p.* 1083. – Phosphoric acid content, *p.* 937. – Experiments in spacing of, and yield from s. b. in Colorado, 68. – Experiments in manuring, *p.* 936. – Influence of progressive application of Nitrate of Soda on quality of s. b., 67. – Comparison of yields of b. in Czecoslovakia, 588. – S. b. in relation to agricultural costs of production, 623. – Cost of production in Hungary, 627. – Dried b. slices and b. flour for livestock, 630. – S. b. crop in Czechoslovakia, 1924, 853. – In Great Britain, 240, 511, 761. – In Holland, *p.* 387. – In U.S.A., experiments in growing in Louisiana, 672. – International Conference of s. b. growers, Warsaw, 1925, 955. – Hygienic conditions of s b., in Belgium, *p.* 91.

Sugar Cane: History of S. c., 512.–

Cytology of s. c., 36. – Light and air in modern cultivation of s. c., 319. – "Critical periods", 823. – Bud selecting in Hawaian s. plantations, 37. – Coimbatore canes selected in Bihar, 69. – New varieties of S. C. at Porto Rico, 248. – "Uba" Cane in Jamaica, 246. – S. C. in Côchin China, 320. – S. c. in Cuba, 678. – Climate and S. C. production in Java, 3. – S. C. in Brazil, 1011. – Experiments in Trinidad, 425; in Louisiana, 903; in Queensland, 70. – Cultivation of S. C. in Queensland, 71. – Mechanical tillage in S. C. plantations, 617. – Manurial Value of S. C. by-products, 558. – Waste material from S. C. in manufacture of Furfural, 108. – First International Congress of Sugar planters and Manufacturers, Honolulu, July 1925, 195.

Sugar plants: S. beet, *p.* 91, *p.* 386; 67, 68, 240, 511, 563, 588, 627, 630, 761. – S. Cane, 3, 36, 37, 69, 70, 71, 108, 195, 246, 248, 319, 320, 425, 512, 558, 617, 678. – Sweet corn, 120. – Nipah palm, 72.

Sulphur: Effects on crop and soil, 279. - Influence on solubility of Soil minerals, 280. – S. in Kentucky rainfall, 1. – Value of S. in Soil improvement, 18. – Colloidal S., and its action on the germination of potato tubers, 568. – Control of wart disease of potatoes by S., *p.* 1061. – S., as insecticide, 820. – – Oxidization of S by *Thiobacillus thiooxidans*, *p.* 1076.

Sumac (*Rhus Coriaria*): cultivation in Spain, 61.

Sumatra: Soil types, *p.* 164. – General Association of Rubber planters experimental Station, 432.

Sunflower: ionolysis, *p.* 14.

Sunn Hemp (*Crotalaria juncea*): production in British Empire, 842.

Sweden: Brown earth, *p.* 403. – Impurities in red clover seed from S., *p.* 1099, *p.* 1110. – Annual of the Swedish Pomological Society, 1046.

Sweet clover (*Melilotus albus*): value in rectifying nitrogen deficiency of soils, *p.* 1079. – As impurity in clover seeds from Canada, *p.* 1126.

Sweet vernal grass: (*Anthoxanthum odoratum*): manuring by ammonium salts, 578.

Switzerland: Federal institute for Agricultural chemistry, Lausanne, 436. – Federal Experimental seed testing institute, Lausanne, 435. – Federal Station of Viticultural experiments, Lausanne and Pully, 434. – Experimental institute for fruit growing, vine-growing and horticulture, Wädenswil, 433. – Courses in agricultural book-keeping, Brougg (Aargau), 437. – Legislation against Cattle disease, 152. – International Goat keeping congress, Fribourg, Sept. 1925, 465. Colonial and Exotic products International Fair, Lausanne, June-July 1925, 212. – Swiss Sample Fair, Bâle, Apr. 1925, 225.

TABEBUIA sp., 635.

Tables: International scientific T., 1023.

Tagetes minuta, 593.

"Tambookie grass" (*Hyperrhenice glauca*) in paper-making, 355.

Tanganyika Territory: see British East Africa.

Tanning: *Caesalpinia Sappan* as used in t., 315. - Oaks and Chestnuts of Burma in t., 604.

Tanning plants: Sumac (*Rhus Coriaria*), 61.

Tasmania: Huon pine essence, 593.

Taungya: Burmese method of forest regeneration, 599.

Tea: T. nurseries, 589. – Cultiv-

ation in Ceylon, 855; in Kenya Colony, 746; in Tranninh, 590; in Dutch Indies, 765. – Analysis with regard to quality, 591.

Tenongia tonkinensis, 316.

Terminalia macroptera, 100.

Teucrium canadense, *p.* 1103. – *T. scorodonia*, *p.* 1078.

Textile plants: T. fibres at the British Empire Exhibition, Wembley, 220. – Plant t. fibres produced in British Empire, 842. – " Babassù" fibre, 850. – Cotton, 39, 56, 108, 140, 183, 309, 310, 311, 312, 411, 423, 424, 497, 498, 506, 580, 581, 582, 636, 658, 663, 745, 842, 844, 845, 846, 847, 848, 849. — *Crotalaria juncea*, 842. – " Curaua ", 233. – Flax, *p.* 386; 224, 308, 380, 563, 583, 750, 842, 843. – *Fourcraea gigantea*, 842. – *Hibiscus cannabinus*, 842. – Jute 842. – Kapok, 842. – Piassava, 850. – Ramie, 842. – Sisal, 313, 584, 585, 658, 842.

Thalaspi arvense, *p.* 1130, *p.* 1136.

Thermotropism: Root thermo-tropism, 283.

Thiobacillus thiooxidans, *p.*1075, *p.*1076.

Thrincia hirta, *p.* 1098, *p.* 1104.

Thyme: essential oil from Cyprus, 593.

Timber: " Balsa " wood, 603. - " Coolibah ", 602. – Eucalyptus, 80, 81, 601, 602. – Pencil cedar from East Africa, 79. – British Guiana woods for paper making, 635. – American fund for study of the chemistry of wood and its derivatives, 677. – Experimental t. preservation in S. Africa, 357. – Diagnosis of decay in t., 637. – T. Technology section at Imperial Forestry Institute, Oxford, 924. – International T. Congress, Lyons, Sept. 1925, 713. – See also: Forestry:

Timothy Grass: (*Phleum pratense*): Legislation in Austria re seeds of T. g., 380. – Regulations in Roumania re germinative power and packing of seeds of T. G., 890. – As impurities in seeds, *p.* 1098, *p.* 1105, *p.* 1110, *p.* 1111, *p.* 1119, *p.* 1126.

Tobacco: *Nicotiana deformis* and the Enzymatic theory of heredity, 34. – Distance of planting and its effect on T. leaf, 856. – T. fertilisers, 321. – Artificial fertilisers and Oil-cake residus for T. crops, 6. – Nicotine: its function, 572, 592. – Cultivation in Brazil, 1011; in Czechoslovakia, 750; in Spain, 390; in Ukraine, 322. – Cultivation encouraged in Martinique, 658. – Hygienic conditions in Belgium, *p.* 92. – III National Congress of Tobacco-growers Bologna, May 1925, 976.

Tomato: Ionolysis, *p.* 14. – Hygienic conditions in Belgium, *p.* 92.

Torilis nodosa, *p.* 1138, *p.* 1152.

Torula: non-sporulating yeast beneficially employed in sugar preservation, 903.

Trade in Agricultural Products: Regulations for sale of Nitrate of Soda in Chile, 881. – Repression of Fraud in Fertiliser Industry in France, 564. – Superphosphate trade in Belgium and Luxemburg, 884. – Importation of Oats in Luxemburg, 889. – Seed T. in Roumania, 890. – Cereal T. in Roumania, *p.* 1007. – Regulation of T. in Cereal Seeds in France, 655. – Form of contract for sale of Algerial Corn. (Marseilles), 718. – U.S.A. methods essential for T., in High Grade Hay, 112. – Price of Coffee in Brazil, 141. – Meat and Coffee Export T. of Brazil, 757. – Trade in cotton, rubber, rice, kola and bird lime of Ivory Coast, 886. – Cotton grading in Sudan, South Africa, and Queensland, 844. – Cotton

growing in Madras, 849. - Marketing of American-grown Bermuda Onions, 633. – T. in A. P. in Holland, *p*. 387. – T. in Livestock and Animal Products of Esthonia, 883. - Frauds in Wool t. in Morocco, 875. -- Pubblicity Fair, Leipzig, 1925, 476. — Transport Exhibition, Munich, 1925, 493. - Pan-American Conference on Standardisation, Lima, 1924, 194. - Cotton Standards, 498, 506. - Annual meeting of Metric Association, Washington, 204. – Adoption of Metric system in Japan, 760. – French National Week for Export of agric. products, 962. – National Commerce Exhibition, Liverpool, July 1925, 1004. – First Exhibition of Industry, Commerce and Agriculture, Fiume, Italy, 1925, 492. – Permanent Exhibition of International T., New Orleans, 482. – *Oesterreichische landwirtschaftliche Marktzeitung*, 1038.

Transpiration of coniferous tree seedlings, 31.

Transport of agricultural products: T. of cotton in Nyassaland, 1016. – T. of American-grown Bermuda Onions, 633. – Overseas T. of Apples, 632. – T. of citrus fruits, 114. – Cost of T. in tropical Africa, 628. – International Road Congress, Milan, Sept. 1926, 714. – T. Exhibbition, Munich, June-Oct. 1925, 493. – See also: Trade in agricultural products.

Trapa (Water chestnut), *p*. 676.

Trichostema dichotomum, *p*. 1102, *p*. 1125.

Trifolium angustifolium, *p*. 1153, *p*. 1154. – *T. arvense*, *p*. 1099. – *T. hybridum*, *p*. 1104, *p*. 1108, *p*. 1110, *p*. 1111, *p*. 1115, *p*. 1119, *p*. 1126, *p*. 1130. – *T. parviflorum*, *p*. 1101. – *T. pratense*, see Clover. – *T. procumbens*, *p*. 1099. – *T. repens*, *p*. 1105, *p*. 1110, *p*. 1111, *p*. 1115, *p*. 1119, *p*. 1126, *p*. 1129. – *T. stellatum*, *p*. 1153, *p*. 1154. – *T. striatum*, *p*. 1098, *p*. 1099. – *T. supinum*, *p*. 1104, *p*. 1155 to *p*. 1158.

Trigonella Besseriana, *p*. 1102.

Trinidad: see British West Indies.

Triplaria surinamensis, 635.

Tripolitania: Regulation of agricultural services of T., 187. – *Salvia spinosa*, useful aromatic plant in Cyrenaica, 74.

Triticum, Hybrids with *Aegilops*, 297.

Trollius, *p*. 333.

Tropical Africa: Transport in T. A., 628.

Troughs: Self-feeders in Hog feeding experiments, 96.

Tsauri grass (*Cymbopogon giganteum*), 593.

Tuba root (*Derris elliptica*), 900.

Tuberculosis (avian): The eggs of tuberculous fowls in the transmission of avian t., 82.

"Tucuman" (*Astrocaryon tucuman*), 755.

Tufa chalk in Lettonia *p*. 750.

Tunis: Classification of wheat varieties cultivated in T., 1027. – Impurities found among barley seed from T., *p*. 1138. – Lagrenée breed of Sheep, 344. – Pig breeding, 611, 1029. – Agricultural education, 921.

Turkey: Turkish floating exhibition, July 1925, 1009.

Turnip: Anatomy of root and stem formation, 23. – Cultivation in Holland, *p*. 386. – Utilization of solar energy, 563. – Extraction of substances similar to Insulin from t., 570. – Hygienic conditions in Belgium, *p*. 92.

UDDER inflammation, *p*. 67.

Uganda: see British East Africa.

Union of South Africa: Report of Department of agriculture, 705. –

Nitrification of Soils in the Transvaal, *p*. 431. – Drought Commission of S. Africa, 709. – Irrigation, 615. - Cotton growing in Nyasaland, 1016. – Cotton grading, 844. – Flax industry, 583. – Essential oils of *Ocimum gratissimum* and *Tagetes minuta*, 593. – American stocks in viticulture tested in S. Africa, 859. – *Abutilon tortuosum* in paper-making, 636. – Diseases of domestic animals, *p*. 58. – Measures for control of diseases of plants and animals in Nyasaland, 146.

United States: Report re measures taken to encourage agricultural progress in U. S., 711. – Development of Federal crop reporting service, 698. – Agricultural regions of North Dakota, *p*. 1085. – Sulphur and Nitrogen in Kentucky rainfall, 1. – Wheat yield and rainfall in Ohio, 2. – National institute for colloid research, 179. – Protozoan fauna of U. S. soils, *p*. 429. – Origin and geographical affinities of Californian flora, 824. – Potash industry, 812. – Annual report of American research laboratory for fixed Nitrogen, 676. – Fallow experiments in Montana, 619. – Red winter wheats in dry areas of Western U. S., 831. – Impurities in red clover seed from U. S., *p*.1102, *p*. 1119, *p*. 1123. – Experiments in cereal growing (Nebraska), 673.– Fertilizing rice (Louisiana), 46. – Italian Silo tests (Wisconsin), 238.– Hay grading and marketing methods, 112. – Seed potato improvement methods, 42. – Experiments in Sugar beet growing (Louisiana), 672. – Growing of Pima and Upland Cotton in Arizona, 312. – Community Cotton production, 498. – Bermuda Onion industry, 633. – Walnut culture in California, 597. – Almond varieties in U. S., 596. – Orchard practices in Citrus industry (S. California), 594. – Tropical Plant research foundation, Washington, 904. – Gardening Conference 907. – Federal forest legislation, 143. – National forest reserve (New-Hampshire), 744. – Scientific methods of forestry in Harvard Forest, Petersham, 161. – Forest experiment Station in Pacific region, 160. - 60th Anniversary of Colorado Springs forest experiment Station, 159. – National Conference on utilization of forest products, Washington, Nov. 1924, 205. – Livestock experiment Station, Miles City (Montana), 910. – Report on International dairy Congress, Oct. 1923, 455. – Inspection division, (Dept., of Interior): consolidation, 144. – Farm organisation in central Kansas, 624. – International institute of cooperation, 541. – German agricultural delegation in U. S., 754. – Construction of a reservoir in Idaho, 237. – American Association for advancement of Science, 699. – American parasitological Society, 446. – Agricultural experiment Stations, Louisiana, 903. – Michigan University Biological Station, 908. – Lehigh research institute, 162. – Centenary of the Franklin Institute and of the Reusselaer Polytechnic, 180. – Bequest for research in agricultural chemistry, 416. – Boyce-Thompson Institute for plant research, Yonkers, N. Y., 415. – Rural science courses at Virginia Polytechnic Institute, 674. – Course of lectures at Pittsburg industrial research institute, 163. – Foundation for study of Chemistry of wood and its derivatives, 677. – Transfer of collection of type culture of Bacteria of American Nat-

ural History Museum to McCormick memorial Institute, Chicago, 909. – Proceedings of 56th convention of Farmers and Fruitgrowers, Sta Ana, California, 203. – International seed exchange: correspondence invited by Brooklyn Botanic Garden, 675. – Annual meeting of metric assoc. Washington, Dec. 1924, 204. – Colorimetry at the National Bureau of Standards, Washington, 164. - Periodicals: *Missouri Yearbook of Agriculture*, 779. - *International Biological Abstracts*, 526. – *Journal of Oil and Fat Industries*. 527.

Urea as a fertilizer, 276. – In Austria, 281. - For Tobacco, 321. - Adsorption of U. by fungi, 571.

Urephos, an atmospheric-nitrogen fertilizer, 276.

" Urucury " (*Attalea excelsa*), 755.

Uruguay: Agricultural progress, 232. – International sheep Show, Montevideo, Feb. 1924, 213.

" Uspulun ", 435. – Influence of U. on germination of potato, 568.

VACCARIA SEGETALIS, p. 1169.

Vaccinietum uliginosi, p. 1078.

Valerianella dentata, p. 1130.

Valuations (Agricultural), treatise on, 625.

Vanilla: Cultivation encouraged in Martinique, 658.

" Varana " (*Paullinia Cupana*), 226.

Vatica astrotricha, V. Dyeri, V. faginea, V. Harmandiana, V. Philastreana, V. Thorelli, V. tonkinensis, 852.

Vegetable Ivory (*Phytelephas macrocarpa*): in Brazil, 226, 850; as Oil-Palm, 755; from the " Babassù " (*Attalea, Orbignia*), 850.

Vegetable marrow: ionolysis, *p.* 13.

Venezuela: Protection of forests and water reserves, 665.

Verbena angustifolia, p. 1103. – *V. hastata, p.* 1103. – *V. officinalis, p.* 1101, *p.* 1115. – *V. urticifolia, p.* 1103.

Veronica officinalis, p. 333. – *V. peregrina, p.* 333, *p.* 1103. – *V. Tournefortii, p.* 1130.

Vetch: utilisation of solar energy, 563.

Vetiver, 593.

Vicia sp., *p.* 1175.

Vigna marina (Silani), 579.

Vine growing and wine production: see Enology.

Vipers: information re, 948.

Vitamines: Stimulating influence of V. on growth, 334. – V. in fungi, 634. – V. in milk, 94, 95, 342. – V. in Calf feeding, 609.

Viticulture: cultivation of vine in dune sand, *p.* 728. - American stocks for V. in S. Africa, 859. – Long pruning of the vine, 327. – Experiments in V., with the Maroger system, *p.* 351. – International competition of Viticultural machinery, Barletta, 977. – Hygienic condition of the vine in Belgium, *p.* 94. – Vine shoots as cattle feed, 607. – V. in Brazil 1011; in Roumania, *p.* 35; in Russia, *p.* 17, *p.* 357. – Legislation for the encouragement of V. in Kingdom of Serbs, Croats and Slovenes, 151. Higher instruction in V., in Germany, 154. – Swiss experimental institute for V. at Wädenswil, 433. – Federal Station of V. experiments, Lausanne and Pully (Switzerland), 434. – V. and Winemaking Congress, Casale Monferrato, Sept. 1924, 207. – Congress on Vines and Wine, Trento, June 1925, 974. – Congress of Table grapes, Agen (France) Aug. 1925, 964. — Congress of Vine-growers at Valencia, Spain, Nov. 1924, 470.

WALNUT : culture in California, 597. – Hygienic conditions in Belgium, *p.* 94.

Wanasoro (*Cecropia juranyana*), 635.

Water chestnuts (*Trapa natans*)., *p.* 676.

Water devining, 505.

Wheat : Yield and rainfall in Ohio, 2. – Ecological problem of W., *p.* 774. – " Critical periods " of W., 823. – Weed seeds of W., *p.* 1169. – Blooming of W. flowers, 285. – Utilization of solar energy, 563. – Phosphoric-acid content, *p.* 928. – Spacing of W. crops, 880. – Effect of Spacing on yield of W., 832. – Relation of Soil-moisture and Nitrogen to yield of W., *p.* 439. – Tolerance of W. for Soil Alkalis, 303. – Acidity changes during growth period of W., 567. – Inheritance of Pubescence of the Nodes in crosses of two varieties of W., 298. – Inheritance of resistance to rust in crosses of Durum W., 833. – Genetic relation between *Triticum dicoccum dicoccoides* and similar morphological types, 296. – Hybrids from W. and *Aegilops*, 297. – Origin and value of " Bena " W., 44. – Classification of principal varieties of W. in France and French N. Africa, 1027. – English W., 499. – " Yeoman II ", a new seed W., 239, 1030. – Production of pure seed in Italy, 688. – New varieties in Queensland, 830. – Irrigation and growth, 614. – Red winter W., in dry areas of Western U.S.A., 831. – Cultivation of W. in Austria by Spaced-Row system, 616. – Experiments with fallow, 619. – Cost of production, 623. – Regulation of trade in cereal seeds (France), 655. – Contract for sale of Algerian W., 718. – Hygienic conditions in Belgium, *p.* 89. – W. in Brazil, 1011. – Experimental cultivation of W. in " Patronatos agrícolas", Rio Grande do Sul, Brazil, 410. – Production in Canada, *p.* 413. – Competition for finest ear of W. in France, Bordeaux, Oct. 1925, 997. – For finest ear of W. in Italy, 427. – Roumanian regulations for W., 664, 819. – Cultivation of W., in Roumania, *p.* 338; in Holland, *p.* 386.

Wild Rice (*Zizania aquatica*) : nutritive properties, 28.

Windbreaks, in orchard planning for cultivation of citrus trees inEgypt, 76.

Wine : see Enology.

Wine lees : oil extracted from, 912.

Wood : see Timber.

Wood in paper-making, 635.

Wool : classification of Moroccan wools, 875.

YEAST : as supplementary food for dairy cows, 867.

Yellow vetchling (*Lathyrus pratensis*); Grass-land and manuring, 578.

" Yeoman II " (Wheat), 239.

Yorkshire Fog (*Holcus lanatus*) ; Grass-land and manuring, 578.

ZIZANIA aquatica : nutritive properties, 28.

Zones of vegetation in Canada,242.

B) INDEX OF AUTHORS

Aarnio, B., *p.* 403; *p.* 451; *p.* 758.
Aarnio B., and Stremme H., *p.* 758.
Abel, 281.
Adam, 1010.
Adams, H. R., 279.
Adams, J., 566.
Adinarayana, K., 807.
Afanassiew, see Afanassieff.
Afanassieff, J. N. A., *p.* 441, *p.* 746.
Albert, *p.* 744.
Albrecht, 505, 616.
Allison, R. V., 276, *p.* 429.
Andersen, A. C. and Winther, J. E. 363, 638.
Andersen, Johannes, *p.* 451.
Anderson, R. J., and Nabenhauer, F. P., 293.
Anderson, T., *p.* 1173.
Appleman, C. O., 43, 120.
Archbold, H. K., 631.
Arrhenius, O., *p.* 123, *p.* 435, *p.* 449, *p.* 755.
Artschwager, E., 24.
Atkins, W. R. G., *p.* 145, *p.* 147.
Avattaneo, R., *p.* 725.
Azadian, A., 366.
Azzi, G., *p.* 766.

Babcock, C. J., 341.
Baker, E., 583.
Baker, W. G., 811.
Balks, R., *p.* 733.
Barber, C. A., 849.
Barnette, R. M., 271.
Barnette, R. M., Gerretsen, F. C., Hissink, D. J., and van der Spek, J., *p.* 449.
Barnette, R. M., Hissink, D. J., and van der Spek, J., *p.* 449.
Baron-Hay, G. K., 810.
Bartels, P. M., 6.
Barthel, Chr., *p.* 435.
Batchelor, L. D., 597.
Baule, B., *p.* 164.
Becker, R. B., 872.
Beets, A. N. J., 321.
Bemis, K., 42.
Benaiges de Aris, C., 325, 349.
Bengtsson, N., *p.* 415.
Bertrand, G. and Mokragnatz, N., *p.* 1056.
Biilmann, Einar, *p.* 142.
Bijhouver, J., 858.
Bjoerlykke, K. O., *p.* 451, *p.* 453, *p.* 756.
Black, W. R., 682.
Blackman, V. H., 829.
Blackshaw, G. N., 311.
Blair, A. W. and Prince, A. L., *p.* 144.
Blair, W. S., 556.
Blanc, G. A., 813.
Blanck, E. and Alten, F., *p.* 449, *p.* 451.
Blarick, R. and Gieseck, F., *p.* 164.
Blanck, C. and Passarge, S., *p.* 733, *p.* 756.
Blanck, C. and Petersen, H., *p.* 164.
Blanck, E. and Rieser, A., *p.* 1088.
Blanck, E. and Scheffer, F., *p.* 756.
Blanford, H. R., 599.
Blaringhem, L., 835, 1026.
Boischot, P., *p.* 1057.
Bond, J. R., 621.
Bondorff, K. A. and Christensen, H. R., *p.* 164.
Bonnet, J., 912.
Bordiga, O., 625.

Botkin, C. W., *p.* 1054.
Bouyoucos, G. J., *p.* 411.
Bouyoucos, G. J. and Mc Cool, M. M., *p.* 133.
Brackenbury, R. H., 628.
Bradfield, R., *p.* 143, *p.* 1057.
Braenhaeuser, M., *p.* 758.
Braham, J. M., 275, 561.
Brancovici, E. M., *p.* 1004.
Braver, A. J., *p.* 736.
Breckenridge, J. E., 809.
Bremer, G., 36.
Brenchley, W. E., *p.* 736.
Brendel, L., *p.* 758.
Brenner, W., *p.* 450, *p.* 451, *p.* 756.
Bresaola, M., 52.
Brezeale, F. J., *p.* 155; 284.
Bristol Muriel, B. and Page, H. J., *p.* 438.
Brocq-Rousseux, 865.
Brown, T. W., 76.
Bruce, J. R., 333.
Brunner, J., *p.* 1089.
Bryce, G. and Gadd, C. H., 65.
Buchholz, Y., *p.* 1174.
Burd, J. S. and Martin J. C., *p.* 415.
Burgess P. S., 270.
Bussard, L., *p.* 1174.
Butler, E. J., *p.* 369.
Buxton, P. A., *p.* 728, *p.* 731.
Buxton, N. E., 103.

CANDLISH, A. C. and Vicar, A., 871.
Canney, E. E., 580.
Cannon, W. A., 30.
Caravaglia, A. C., 581.
Carter, L. M., Lowry, M. W., Collins, W. O. and Soule, A. M., *p.* 449.
Carter, L. M., Lowry, M. W., Collins, W. O., Soule, A. M., Glemn, L. and Fuller, *p.* 449.
Carton, P., 316.
Castro, J. A., 234.
Cavara, F., 74.
Cesar, G. A., 309.
Chace, E. M., and Denny, F. E., 116.
Chace, E. M., Church, C. G., and Denny, F. E., 35, 75.
Challis, E. C., 122.
Champy, C. H. and Kritch, V., 606.
Charmeux, F., 119.
Cheeseman, E. E., 565.
Chevalier, A., 858.
Chibnall, A. C., 292, 826.
Chibnall, A. C., and Nolan, L. S., 291.
Chodat, F., *p.* 1077.
Chouchack, D., *p.* 742.
Christensen, H. R., *p.* 165, *p.* 451.
Chung, H. L. and Kipperton, J. C., 839.
Ciurea, T. and Dinulescu, G., 329.
Clarke, G. R., *p.* 436, *p.* 736.
Clark, J. A. and Martin J. H., 831.
Clark, N. A., *p.* 148.
Colin, H. and Grandsire, A., 825.
Comber, N. M., *p.* 1088.
Conner, S. D., *p.* 154.
Constantinesco, G. K., *p.* 972.
Cook, O. F. and Martin, R. D., 312, 498.
Cooper, H. R., 589.
Corrêa, P, 1021.
Costa, A., 757.
Coudis, C. H., 367.
Crevost, Ch., 852.
Cruess, W. V., 354.
Cumin, G., *p.* 1080.
Curtis, H. A., 561.
Curtis, H. A. and Ernst, F. A., 561.
Cutler, D. W., *p.* 429.
Cutler, D. W., Crump, L. M. and Sandon, H., *p.* 430.
Cutler, J. V., 592.

DACHNOWSKI, A. P., *p.* 756, *p.* 1058.
Dahl, C. G., 1037.
Dalencour, F., 166.
Daniels, A. M., Seitz, C. E. and Glenn, J. C., 879.
Darby, H. D. E., 62.
Dash, J. S., 617.
Da Silva Bernardes, A., 898, 943, 1011.
Davenport, K. H. and Robinson, R., 332.

Davidson, J. and Wherry, E. I., 33.
Davin, A. and Searle, G. O., 843.
Davis, L. V., *p.* 453.
Dayhuff, W. C. and Hoagland, D. R., *p.* 416.
De Campos, D., 309, 944.
Dechambre, P., 870.
Deibl, P. W. 351.
Deigthon, T., *p.* 411.
De Jong, A. W. K., 432.
De Leon, J., 115.
De Malachouski, A., 99.
Demoll, R., 878.
Demolon, A., *p.* 431, *p.* 1058, *p.* 1059.
Deuss, J. J. R., 591.
De Vries, O., 356.
Diaz Ossa, *p.* 942.
Dickenson, J. R., 821.
Dobrescu-Cluy, J. M., *p.* 1088.
Dockeray, R., 103.
Dojarenko, A. G., *p.* 416, 563.
Dowling, R. N., 103, 1031.
Duley, F. L., *p.* 1059.
Duley, F. L. and Miller, M. G., *p.* 1055, *p.* 1078.
Dunlop, W. R., 352.
Dunstan, M. J. R., 103.
Du Pasquier, R., 590.
Du Plessis, A. M., 859.
Dusserre, C., 436.
Dymond, G. C., 558.
Dymont, T. S., 857.

EASTERBY, H. T., 71.
Easterby, H. T. and Patten, G. R., 70.
Eastham, A., *p.* 1175.
Eaton, B. J., 622.
Eaton, B. J. and Dennet, J.H., 72.
Eckles, C. H. and Williams, V. M., 867.
Edlmann, L., *p.* 163.
Egana, S. C., 345.
Ehrenberg, P., Nolte, O., von Zyl, J. P., Hahn-Haslinger, J., Ungerer, E., Lunau, E. and Pfotenkauer, Ch., *p.* 757.
Eisler, M. and Portheim, L., 573.
Elmer Wylie, C., 864.
Encoulesco, P., *p.* 452.
Engels, *p.* 451.
Engledow, F. L., 832.
English, E. F., 355.
Erdmannsdoerffer, O., *p.* 409.
Eschenhagen, M., 286.
Evans, G., 844, 845.

FAIN, I. R., *p.* 449.
Ferreira, E., 302.
Fischer, H., *p.* 1081.
Fischer, K., *p.* 448, *p.* 1087.
Fisher, E. A., *p.* 134, *p.* 138, *p.* 1088.
Fisher, R. A. and Oden, S., *p.* 136.
Fitch, C. P., Lubbehusen, R. E. and Dikmans, R. N., 82.
Fleury, P., 100.
Florez, R., 696.
Fornari, V., 101.
Forti, C., 268.
Foster-Bain, H. and Mulliken, H. S., 561.
Foscaner, J., 854.
Fouassier, M., 123.
Fox, E. J. and Whithaker, C. W., 814.
Franchot, R., 14.
François, L., *p.* 1134.
Fred, E. B., *p.* 431.
Fredericksen, L., Andersen, A. C. and Wenzel, H., 873.
Freeman, J. F., 1.
Frosterus, B., *p.* 452.
Frosterus, B. and Frauenfelder, H., *p.* 100.

GALLAY, R., *p.* 449.
Ganssen, R., *p.* 140, *p.* 158.
Ganssen R. and Goerz, G., *p.* 744, *p.* 758.
Garbin, G., 245.
Garner, W. W., Bacon, C. W. and Allard, H. A., 32.
Garola, C. V., and Chartres, *p.* 732.
Geldard, W. J. and Chase, W. D., 560.

Gehring, A. and Werrmann, O., *p.* 756.
Geneste, F., 610.
Gentner, G., *p.* 1095.
Georghi, C. D. V., 110.
Gerlach, *p.* 437.
Gessner, H., *p.* 756.
Glaser, F. and Wittner, L., 570.
Glinka, C. D., *p.* 452.
Glinka, K., *p.* 160; *p.* 165, *p.* 749.
Glomme, H., *p.* 755, *p.* 1081.
Gibson, A. L., 362.
Ginies, 344.
Giuliani, R., 607.
Gnecco, E., 515.
Goerg, R. and Meigen, W., *p.* 165.
Golonka, Z., *p.* 1089.
Gorini, C., *p.* 65.
Gorski, and Jankowska, W., *p.* 1088.
Goss, L., *p.* 1176.
Gossner, B., *p.* 409.
Gotzinger, 281.
Goudie, H. A., 601.
Gouin, 85.
Gram, M., 113.
Gravigne, Gillet and Denizet, *p.* 1082.
Gray, W. S., 823.
Greaves, J. E. and Carter, E. G., *p.* 757.
Greaves, J. E., Carter, E. G., and Lund, Y., *p.* 757.
Greaves, J. E. and Hirst, O. T., *p.* 756
Greaves, J. E. and Lund, Y., *p.* 755.
Greaves, J. E. and Nelson, D. H., *p.* 757.
Greenstreet, V. R., 29, 587.
Grillo, E., 1013.
Grimes, W. E., Hodges, J. A., Nichols, E. D. and Tapp, J. W., 624.
Groysbeck, 616.
Guernsey, E. W. and Yee, J. Y., *p.* 173.
Guerra, A., 309.
Guillaume, H., 314.
Guth, 874.
Gutschmidt, 351.

Haas, P. and Lee, B., 361.
Hall, I. C., and Petersen, E. C., *p.* 151.
Hall, T. D., *p.* 431.
Hallisy, T., *p.* 452.
Hanley, J. A., 55.
Hardy, F., *p.* 412; 108, 272.
Harland, S. C., 73, 565, 579, 620.
Harland, S. C., and Parga, R. H., 323.
Harler, C. R., 855.
Harper, H. J., *p.* 146.
Harper, H. J. and Jacobson, H. G. M., *p.* 417.
Harrassowitz, H. L. F. and Meige, W., *p.* 165.
Harritnon, J. B., 833.
Harris, F. S., *p.* 745.
Harris, F. S. and Turpin, H. W., *p.* 755.
Hartman, H., 117.
Hartwell, B. L., Damon, S. C. and Crandall, F. K., 13.
Haunalter, E., 307.
Hawkins, R. S., 827.
Haynes, D., 631.
Headden, W. P., *p.* 756; *p.* 757, *p.* 1088, *p.* 1089.
Heggenhougen. S., *p.* 165.
Henrich, F., *p.* 756.
Heppner, M. J., 22.
Hess, A. F. and Weinstock, M., 335.
Hesse, J. G., 844.
Hibbard, P. L., *p.* 145.
Hissink, D. J., *p.* 165, *p.* 448, *p.* 449, *p.* 452, *p.* 705, *p.* 756, *p.* 758, *p.* 1060, *p.* 1087, *p.* 1088, *p.* 1090.
Hissink, D. J. and Brockmann, C., *p.* 759.
Hissink, D. J. and Van der Spek, J., *p.* 757, *p.* 1087.
Hissink, D. J. and Zylstra, K., *p.* 758.
Hoagland, D. R. and Martin, J. C., *p.* 437.
Hoc, P., 630.
Holland, T. H., 66.
Holtz, H. F. and Singleton, H. P., *p.* 1079.
Honing, J. A., 34.
Hooper, C. H., 77.
Hooper, J. J., 89.

Hopkins, E. S., *p.* 413.
Howard, A., 586.
Hubert, E. E, 637.
Hudig, J. and Hetterschy, C. W. G., *p.* 165.
Hume, W. R., *p.* 452.
Humphries, D. A. E., 499.
Hurd, A. M., 567.

IBSEN, C. H., 363.
Iliffe, R. O., 45, 837.
Imatong, S. B., 856.
Israelsen, Orson, W. and West, F., *p.* 755.
Ivanoff, N. N., 571.

JABLONOWSKI, J., *p.* 468.
Jack, H. W., 47, 851.
Jack, H. W., Bishop, R. O. and Milsum, J. M., 584.
Jackson, C., 305.
Jacob, K. D., Allison, F. E. and Braham, J. M., 278.
Jacob, K. D., Krase, H. J. and Braham, J. M., 277.
Janini Janini, R., 61.
Janota, R., *p.* 750, *p.* 1083.
Jarrel, J. F., 68.
Jasekke, O., 64.
Jensen Tovbord, S., *p.* 417.
Jimenez, A. L., 818.
Jochems, S. C. J., *p.* 453, *p.* 759.
Joffe J. S. and McLean, H. C., *p.* 139, *p.* 157, *p.* 419.
Johansson, S., *p.* 452.
Johnson, E. M., 1.
Johnson, O. M., 819.
Jones, C. P., *p.* 420.
Jones, J. S., *p.* 142.
Jones, O. 121.
Jonescu-Sisesti, G., 501.
Joseph, A. F., *p.* 441.
Joseph, A. F. and Martin, F. J., *p.* 413, 360.
Joshi, F. G., 350.
Joshi, N. Y., 557.
Jull, M. A. and Quinn, J. P., 347.

KACHINSKY, N. A., *p.* 1055.
Kaldhol, H., *p.* 165.
Kallbrunner, H., 281.
Karnowski, L., 306.
Kearney, T. H., 39.
Keen, B. A., 103.
Keinholz, R., 301.
Kellogg, J. W., 16.
Kennedy, C., 28.
Kidd, F. and West, C., 632.
Kinch, E. A., *p.* 1182.
Kinger, J. B., *p.* 451, *p.* 755.
Kinzel, W., *p.* 331.
Klander, F., *p.* 1088.
Kobel, F., 300.
Kober, L., *p.* 410.
Krizenecky, J. and Podhradsky, J., 334.
Krokos, V., *p.* 442.
Kröning. F., 337.
Kucharenko, T. A., *p.* 1, *p.* 651.
Kudriavtzeff, A., 563.
Kvapil, K. and Neměc, A., *p.* 1061.
Kyrle, 281.

LA FORGE, F., 107.
Lago, F. P., 96.
Lallour, M., 875.
Lang, Fr., 895.
Lanzillotti, N., 93.
Larison, E. L., 11.
Laplaud, M., de la Fregonnière and Duffau, 338.
Larue, P., *p.* 452.
Latimer, H. B., 613.
Lebedjantzev, A. N., *p.* 420.
Legendre, G., 90, 877.
Leger, C., 611.
Leighty, C. E and Sando, W. J., 285.
Leiningen (Graf zu) W., *p.* 155.
Lemmermann, O., *p.* 165, *p.* 757, *p.* 758.
Lemmermann, O. and Reserius, L., *p.* 165.
Lemmermann, O. and Weissmann, H., *p.* 165, *p.* 758.

Leoncini, G. and Rogai, F. A., 562.
Le Roy A. 824.
Leroy, A. M., 868.
Leroy A. and Recoura, M. G., 343.
Lesné and Vagliano, 95.
Lesne, E., Turpin, R. and Zizine, O., 331.
Lester, V., 358.
Levine, C. O. and To S. T., 92.
Lewicki, S. and Dutkiewiczowna, B., 297.
Leymen, E., 862.
Lichtenberg, J. E., *p.* 755.
Linck, G. and Blanck, E., *p.* 449.
Linscott, C. O., 615.
Lipman, C. B. and Wank, M. E., 273.
Lipman, J. G., 17, 18.
Lipman, J. G. and Blair, A. W., 15.
Little, A., 86.
Lobbe, H., 304.
Lohmann, J., 568.
Lomanitz, S., 287.
Longley, A. E., 299.
Loos, H., *p.* 164.
Löschnig, 353, 992.
Love, H. H., 296, 298.
Luce, E. M., 342.
Luening, O. and Bebenroth, H., *p.* *p.* 449.
Lugard, F., 1017.
Luthra Chaud, J., 289.
Lyon, T. H., Bizzel, J. A. and Wilson, B. D., *p.* 450.
Lyon, T. L. and Buckman, H. C., *p.* 450.
Lyon, T. L., Heinick, A. J. and Wilson, B. D., *p.* 165.

MABER, E. D., 600.
Mac Donnell, C. C., 820.
McHardy, D. N., 103.
Mains, G. H. and La Forge, F. B., 107.
Makroff, G., *p.* 442.
Malavski, H. and Sypniewski, J., 288.
Marani, G. M., 688.
Manaresi, A. and Gragnani, G. B., 858.
Marbut, C. F., *p.* 453.
Marcello, A., 688.
Marchadier and Goujon, *p.* 737.
Marchal, E., *p.* 88.
Marcq, J., *p.* 58.
Marcusson, J., *p.* 755.
Marie, C., 1023.
Markoff, L., *p.* 17, *p.* 357.
Maroger, E., *p.* 350.
Marquez, F. D., 575.
Marshall, R. C., 598.
Martin, T. L., *p.* 150.
Martinet, G., 435.
Maschaupt, J. G., *p.* 757.
Maschhaupt, J. G. and Hissink, B. J., *p.* 453.
Masini, R., *p.* 446.
Massé, A., 869.
Matthews, A., *p.* 154, *p.* 743.
Mauro, F., 97.
Maymone, B., 91.
Mc Campbell, C. W. and Horlacher, W. R., 84.
McGeorge, W. T., *p.* 147.
McKeon, C., 41.
McLaunglin, W. W., *p.* 135.
Mc Rostie, C. P., 51.
Melnik, M., 605.
Mestre, A., 327.
Miklaszewski, S., *p.* 452.
Millar, C. E., *p.* 148; 828.
Miller, E. C., 27.
Mitscherlich, E., *p.* 410.
Mitra, S. K. and Dutt, S. C., 4.
Mitterhauser, 616.
Miyake, K., Tamachi, I. and Konno, J., *p.* 421.
Montemartini, L., *p.* 10.
Montemayor, Z. T., 40.
Monti, E., 629.
Morris, H. M., *p.* 1075.
Morris, V. H., *p.* 438.
Mors, O. G., 309.
Morgan, G. W., 619.
Muller, H., 433.
Munteanu, A., *p.* 338.

Muenzinger, 623.
Muratori, M., 608.
Murgoci, G., *p.* 452.

NASIR, S. M., *p.* 743.
Neidig, A. E. and Snyder, R. S., *p.* 439.
Neidig, R. E. and Magnuson, H. P., 303.
Nemeč, A., *p.* 1074.
Nemeč, A. and Kvapil, K., *p.* 450, *p.* 738.
Neubauer, H., 281.
Nilmeyer, L., *p.* 432.
Niesel, Max, 1024.
Niklás, H., *p.* 440.
Niklás, H. and Hock, A., *p.* 422, *p.* 450, *p.* 739.
Nikáls, H. and Vogel, F., *p.* 1018.
Nitzeschu, I. I. and Nicoleau, G., 330.
Nogueira, O. P., 309.
Nommik, A., *p.* 1089.
Novák, N., *p.* 452
Novikoff, M, *p.* 151.

OLSON, M. T. and Capeland, L., 94.
Orr, J. B., Crichton, A., North, B. M., Kinross, A., Moir, M. and Newbiggin, H., 83.
Ostenfeld, C. H., 412.

PAGANI, P., 516.
Page, H. J., *p.* 1089.
Page, H. J. and Williams, W., *p.* 1089.
Pankoff, A., *p.* 448, *p.* 450, *p.* 453.
Pantano, E., 500, 764.
Parker, E. C., 112.
Pawlik, 616.
Pearse, A. S., 309.
Pearson, G. A., 31.
Peel, F. B., 56.
Perry, P. R., 42.
Petersen, W. H. and Burckly, L. A., 238.
Pézard, Sand and Caridroit, 612.
Philip, G. (and Son) and Sheldrake, T. S., 1034.
Pilgrim, J. A., 604.
Pinching, H. C., 64.
Pinckeney, R. M., 569.
Pinotti, M., 507, 758.
Pirotta, R., *p.* 768.
Pittmann, S. W., *p.* 755.
Pope, G. W., 861.
Popoff, 322.
Porcherel, A., *p.* 982.
Porto, H., 226.
Post, V. L., *p.* 452.
Potonié, R. and Seitz, O., *p.* 729; *p.* 755.
Prack, L., 627.
Prassolov, L., *p.* 1083.
Preaud, M. R., 1028.
Prescott, J. A., 846, 880.
Prêtre, H. and Guillaume, P., 320.
Prianischnikoff, D., 26.
Pridham, J. T., 44.
Primitz, 616.
Princ pi, P., *p.* 446.
Proks, J., 359, 639.

QUINTANILLA, G., 349.
Quodling, H. G., 830.

RAEDER, F., 20.
Ranieri, G., 230.
Ramann, R., 269, *p.* 1089.
Ramsauer, B., *p.* 758.
Ramsay, J. T., 50.
Range, P., *p.* 755.
Reinau, E. H. and Kertscher, F., *p.* 1088.
Reinsch, B., 336.
Reis, O. M., *p.* 453.
Reitmair, 281.
Riccardo, S., *p.* 433.
Richards, M. B., Godden, W. and Husband, A. D., 346.
Richey, F. D. and Willier, J. G., 836.
Rippel, A., *p.* 422.

Robinson, R. and Sloanes, K. M., 332.
Robinson, G. W., *p.* 414, *p.* 453.
Robinson, G. W. and Williams, R. *p.* 740, *p.* 1089.
Rof y Codina, J., 274.
Rohde, E. S., 514.
Rogenhofer, E., *p.* 1176.
Roach, W. A., Glynne, M. D., Brierley, W. B. and Crowther, E. M. *p.* 1061.
Rosendefeld, E. A., 319.
Rosiade, P., 766.
Rothe, J., *p.* 166.
Ross, W., H. Mehring, H. L. and Jones, R. M., 808.
Rothkegel, W., 626.
Rozensteins, S. and Lancmainis, Z., *p.* 750, *p.* 755.

SACHAROW, S., *p.* 729.
Saint, S. I., *p.* 741, *p.* 1089.
Salmon, 640.
Salomon, O. V., 56.
Sanchez, G., 364.
Sandon, H., *p.* 743
Sandon, H. and Cutler, D. W., *p.* 434.
Sawyer, E. R., *p.* 751.
Sayer, W., 69.
Scales, F. M. and Harrison, A. B., 816.
Schadler, D. J., 281.
Scheffer, F., *p.* 741, *p.* 757.
Schermann, 502.
Schiesstl, 616.
Schindler, H., 282.
Schlotterer, J., 407.
Schmid, A. and Lanodis, J., 609.
Schneider, Cl., *p.* 156.
Schneidewind, W., 893.
Schneidewind, W., Münter, F., Hahne, J. and Grobler, W., 893.
Schulte zur Oven, G., *p.* 137, *p.* 138.
Schwalbe, G. and Schepp, R., *p.* 166.
Scott, M. H., 80, 81.
Shamel, A. D., Pomeroy, C. S. and Caryl, R. E., 38.
Shantz, H. L., *p.* 451, *p.* 758.
Shantz, H. L. and Marbut, C. F., *p.* 451.
Sheehy, E. J. and Delaney, D., 111.
Simmonds, J. H., 860.
Sipari, E., 948.
Smith, C. M. and Hendricks, S. B., 822.
Smith, W. G., 578, *p.* 781.
Smolik, L., *p.* 105, *p.* 742.
Soederbaum, H. G. and Barthel. C., *p.* 440.
Solding, H., 23.
Soule, A. M., *p.* 448.
Sourdin, 858.
Spirhanzl, J., *p.* 121, *p.* 158, *p.* 733.
Spurway, C. H., *p.* 423, *p.* 424, *p.* 425.
Straker, E. V., 577.
Stampel, 991.
Stark, R. W., 58.
Starkey, R. L., *p.* 426, *p.* 1075, *p.* 1076.
Stebut, A. A., *p.* 751.
Steidle, H., 634.
Steinert, J., *p.* 729.
Stephens, H. B., 357.
Stephenson, R. E. and Powers, W. L., 280.
Steuart, D. W., 365.
Stevens, W. M., 633.
Stockdale, F. A., 59.
Stoklasa, J., *p.* 921.
Stoklasa, J. and Penkava, J., *p.* 327.
Strand, E., 251.
Stremler, J., 863.
Stremme, H., *p.* 453.
Stuart, W., Lombard, P. M., Vosbury, M. C., Corder G., Edmundson, W. C., Clark, C. F. and Dewey, G. W., 49.
Stütz, 443.
Suechting, H., *p.* 451.
Summers, F., 582.
Suppler, G. C. and Bellis, B., 123.
Sutton, W. C., 614.
Swanson, C. O., *p.* 141.

TAYLOR, H. V., 946.
Teixeira, 496.
Templeton, J., 848.

Tengwall, T. A. and Van der Zyl, C. E., 3.
Tennant, R. B. and Marks, J. R., 102.
Teodorescu, I. C., *p.* 35.
Tesch, P., *p.* 453.
Terroin, E. F. and Splinder, H., 641.
Texeira da Fonseca, E. O., 850.
Theron, J. J. and Cutler, J. V., 572.
Theron, J. J. and Hall, T. D., 86.
Thiriet, A., 57.
Thornton, H. E., *p.* 434.
Thornton, H. G. and Gangulee, N., *p.* 1076.
Tidmore, J. W. and Parker, F. W., *p.* 427.
Tikel, R., 295.
Till, A., *p.* 440, *p.* 453.
Tinlin, A., *p.* 1061.
Torstensson, G. and Tathsack, K., *p.* 166.
Treitel, O., 283.
Treitz, P., *p.* 453.
Trénel, M., *p.* 1011.
Tricard, A., 339.
Trofinoff, A. B. 563 ; *p.* 427.
Turrentine, J. W., 812.
Turrentine, J. W. and Tanner, H. C., 12.

URBAN J., 853.
Urban, J. and Soucek, 67.

VAILE, R. S., 594.
Van Rijn, J. J. L., *p.* 385.
Vanderist, H., 19, 54.
Vanstone, E., 559.
Venkatraman, T. S. and Thomas, R., 21.
Vermorel, M., 236.
Vignolo Lutati, 315.
Vilensky D., *p.* 450, *p.* 1036, *p.* 1089.
Vilmorin, H. and Vilmorin, J., 1027.
Vincent, V., *p.* 427.
Vitins, J., *p.* 452, *p.* 730, *p.* 755, *p.* 757, *p.* 759.
Vittet, J., N., 53.
Voitellier, Ch., 98, 510, 915.
Von Degen, A., *p.* 1175.
Von Fellenberg, Th., 25.
Von Linstow, O., *p.* 438.
Von Nostitz, A., *p.* 437, *p.* 1088.
Von Petery, W., *p.* 1163.

WAGGAMAN, W. H., 9.
Waggaman, W. H., Easterwood, H. W. and Turkey, T. B., 10
Wakefield, F. W., 114.
Waksman, S. A., and Karunakar, P. D., *p.* 150.
Waksman, S. A. and Starkey, R. L., *p.* 149.
Walters, J. A. T., 841.
Walther, J., *p.* 158.
Ward, J. S. M., 842.
Waters, R., 118.
Watts, Sir F., 318.
Weaver, J. E., 564.
Webster, J. E., *p.* 753.
Webster, J. F. and Viswanath, N., *p.* 753, *p.* 754.
Weinschenk, *p.* 410.
Weis, F., *p.* 757.
Welch, F. C., 5.
Welsch, J., *p.* 1084.
Welton, F. A. and Morris, V. H., 2.
Wester, P. J., 78, 109.
Wettengl, 340.
White, J. W. and Holden, F. J., *p.* 428.
Wiedeman, E., *p.* 451.
Wiegner, G., Gallay, R. and Gessner, H., *p.* 755.
Wieninger, 348, 876.
Wiessmann, H. *p.*, 755, *p.* 1089.
Wilensky, D. C., *p.* 450.
Willner, 281.
Willard, C. J., 840.
Willard, Rex E., *p.* 1085.
Williams, C. S., 847.
Williams, P. S., 866.
Wityn, J., *p.* 452, *p.* 730, *p.* 755, *p.* 757, *p.* 759.
Wolda, G., 88.
Wolff, W., *p.* 453.
Wood, W. N., 596.

Woodworth, C. M., 574.
Worsham, W. A., *p*. 450.
Worsham, W. A., Long, D. D., Carter, L. M. and Lowry, M. W., *p*. 450.
Worsham, W. A., Long D. D., Carter, L. M., Lowry, M. W. and Collins, W. O., *p*. 450.
Wright, A. M., 7.

York, L. L. and Durr, W. W., 673.

Zacharov, S. A., *p*. 1085.
Zavitz, C. a., 834.
Ziegenspeck, H., 290.
Zilva, S. S., 294.
Zilva, S. S. and Connell, S J. B., 294.

V. – DISEASES AND ENEMIES OF PLANTS

(A) INDEX OF SUBJECTS.

ABU Sowaida, bird enemy of locusts, in Upper Iraq, *p.* 1183.

Acalla comariana, destructive to Strawberry crops near Copenhagen, 124.

Acetate: of ethyl, 820; of copper, 820.

Acid fruits: *Chionaspis citri* (= *Howardia citri*) in Uruguay, 137. – Control of "White-red" disease of A. f., 722.

Agrioles lineatus on wheat in Denmark, 124.

Algeria: Measures for checking spread of *Diaspis pentagona*, 398.

Amblymerus maculipennis in Spain, 129.

American boll worm: on cotton in Nyasaland, 1016.

American Parasitological Society, 446.

Ampelopsis Veitchii attacked by mildew (*Plasmopara viticola*) in Germany, 128.

Anthonomus: *A. grandis* (boll weevil), 56. – *A. rubi*, injurious to Strawberries in Denmark, 124.

Antiseptics: Partial Sterilisation of Soil by A., *p.* 154, *p.* 743.

"Apa-Fumus", 124.

Apamea testacea on *Festuca elatior* seed crops and on barley, in Denmark, 124.

Aphides of rose and of *Sonchus*, as parasites of genus *Isobremia kiefferi*, in Jugoslavia, 374.

Aphis: *A. fitchii* on roots of gramінaceae in Denmark, 124. – *A. rosae*, *A. rosarum*, A. *sonchi*, attacked by *Isobremia kiefferi*, in Jugoslavia, 374. – *Isobremia sonchi*, external parasite of *A. sonchi*, 374. – *A. viciae*, injurious to peas in Roumania, *p.* 692.

Apiosporium sp. injurious to hops in Belgium, *p.* 92.

Apple tree: *Blastodacna putripenella* in Denmark, 124. – Brown fruit rot (*Sclerotinia fructigena*) in Belgium, *p.* 93. – Canker (*Nectria galligena*) in Belgium, *p.* 93. – *Carpocapsa pomonella* in Denmark, 124. – *Cheimatobia boreata* and *Ch. brumata* in Denmark, 124. – *Hoplocampa fulvicornis* and *H. testudinea* in Denmark, 124. – Legislation against the A. weevil, in Austria, 381. – A. mildew in relation to meteorological conditions in Württemberg, *p.* 373. – *Olethreutes ocellana* in Denmark, 124. – Powdery mildew of A. (*Podosphaera leucotricha*) in Belgium, *p.* 93. – Root-rot (*Armillaria mellea*) of A., in Belgium, *p.* 93. – Scab (*Venturia inaequalis*) in Belgium, *p.* 92. – – Wood and trunk rot of A., in Belgium (Polyporaceae), *p.* 93.

Apples: *Fusarium Willkommii* (*Nectria galligena*) and *Gloeosporium album*, in Denmark, 124.

Apple scab (*Venturia inaequalis*) in Belgium, *p.* 93.

Apple weevil: Legislative measures

against a. w., in Austria, 581. – *Schizoneura lanigera* in Belgium, (legislation against), *p.* 98.

Apricot generally immune from cryptogamic diseases in Belgium, *p.* 93.

Areca Catechu (" Mahali " or " Koleroga "): disease in Malabar, Canara and Maipur, 646.

Argentina: Investigation in regard to weed seeds found among the seeds of Argentina, with reference to their origin and distribution in the producing districts of A., *p.* 1163. – Measures of control against pink boll-worm (*Gelechia gossypiella*), 140.

Armillaria mellea on apples in Belgium, *p.* 93. – On Scots pine in Belgium, *p.* 95.

Arrebatada, on cotton in Peru, 56.

Arsenical compounds as insecticides, 820.

Ascochyta: *A. Fagopyrum* in relation to meteorological conditions, *p.* 379. – *A. piniperda* on spruce fir in Belgium, *p.* 95. – *A. Pisi* injurious to market gardens in Denmark, 124.

Aspidiotus britannicus on *Laurus nobilis* in Great Britain, 649.

Aspidistra: *Volutella ciliata* in Denmark, 124.

Asterocystis radicis injurious to flax in Belgium, *p.* 92.

Austria: Legislative measures for extirpation of barberry (*Berberis vulgaris*), 381; for destruction of Caterpillars on fruit trees, 381; for destruction of Cokchafers, 381; for destruction of *Cuscuta Trifolii*, 381; against diseases and pests of plants, 381; for reporting appearance of apple weevil, 381; of black potato scab, 381. – Cockchafers: legislative measures, 381. – Control of C. in Lower A., 382.

Bacillus: *B. phytophthorus*, cause of "Potato blackleg", disseminated by *Phorbia fuscipennis* in Minnesota, U.S.A., 643. – *B. phyt.* on potato in Belgium, *p.* 90. *B. Savastanoi* injurious to Olives in Portugal, 131.

Bacterium: *Bact. Salicis* injurious to *Salix caerulea* in England, 644. — *Bacterium* sp., injurious to beans in Costa Rica, 370.

Banana: *Brassolis istmia* in Costa Rica, 134.

" Barbasco ", 820.

Barberry: Legislative measures for extirpation of b. in Austria, 381.

Barley: Attacked by *Apamea testacea* larvae in Denmark, 124. – Covered smut (*Ustilago Hordei*) and naked smut (*U. nuda*), and Helminthosporiosis (*Pleospora trichostoma*) in Belgium, *p.* 90. – *Pleospora graminea*, *Tilletia Caries*, *Ustilago Avenae*, *U. Hordei* in Denmark, 124.– Injured by *Tettigonia albifrons* in Bengasi, 648.

Beans: Pod scab (*Colletotrichum Lindemuthianum*) in Belgium, *p.* 92. – *Bacterium* sp. and *Coccus* sp. injurious to B., in Costa Rica, 370. – *Colletotrichum Lindemuthianum* in relation to meteorological conditions, *p.* 379. – B. attacked by *Uromyces Phaseoli* and *Melolontha vulgaris* in Roumania, *p.* 690.

Beet (and Mangel) rot (caused by parasites and bacteria, *Pythium de Baryanum* and *Sphaerella tabifica*) in Belgium *p.* 91.

Beetroot: *Hypochnus Solani* and " mosaic " in Denmark, 124. – Rot (caused by Bacteria, *Pythium de Baryanum*, *Sphaerella tabifica*), *Cercospora beticola*, heart rot (*Sph. tabifica*), mildew (*Peronospora Schachtii*), *Phyllosticta Betae*, *Pleospora putrefaciens*, *Ramularia Betae*, *Uromyces Betae*, in Belgium, *p.* 91.

Belgian Congo: Field and Forest plant diseases, 368.

Belgium: Field and forest plant disases, 368. — Instruction in Phytopathology and agricultural Entomology, 156. – Phytopathological Inspection department, *p.* 97.– Phytopathological legislation, *p.* 97. – Phytopathological organisation, *p.* 95. – The Phytopathological problem, *p.* 88. – Phytopathological research, *pp.* 95-99. – State phytopathological Station at Gembloux, *p.* 95.

"Belumnite" (insecticide), 124.

Berberis vulgaris: Legislative measures for destruction of this plant in Austria, 381.

Betel nut (*Areca Catechu*): "Mahali" or "Koleroga" disease in Malabar, Canara, and Maipur, 646.

Biographical Entomological Dictionary proposed, 251.

Birds: natural enemies of locusts in Iraq, *p.* 1183. – Insectivorous b. and their protection in Spain (legislative measures), 394.

Biston zonarius: injurious to trefoil in Denmark, 124.

"Black bundle disease" of corn, observed in *Zea Mays indentata*, *Z. Mays indurata*, and *Z. Mays saccharata*, in U.S.A., 126.

Black rot (*Pseudomonas campestris*), on cabbages, turnips and mangels, in Belgium, *p.* 92.

"Black scurf" of potatoes, 42.

Blastodacna putripenella on apples, 124.

Blister disease on plum (*Taphrina Pruni*) in Belgium, *p.* 93.

Boll weevil, (*Anthonomus grandis*) 56.

Botrytis: *B. cinerea*, 125. – *B.* injurious to vegetables in Denmark, 124.

Brassolis istmia injurious to coconut and other plants in Republic of Costa Rica, 134.

Brazil: Coffee: diseases in State of São Paulo, 647. – *Stephanoderes coffeae* injurious to C. plant, 1011, 1013. – *Protapanteles marquesi* parasite of *Papilio anchisiades capys*, injurious to oranges in B., 375. – Cleaning and disinfection of seed, 943. – *Solanum paniculatum* and tobacco: *Phthorimaea operculella*, 377.

Broad beans: damaged by *Glomerella Lindemuthiana* and *Sclerotinia sclerotiorum*, in Denmark, 124.

"Brown tail moth" (*Euproctis chrysorrhoea*), 131.

Bruchus pisi, injurious to peas in Roumania, *p.* 691, *p.* 692.

"Bugerada", (*Tettigonia albifrons*) speckled locust, in Bengasi, 648.

"Bugiarada" (*Tettigonia albifrons*), see "Bugerada", 648.

Bulbs: Eel-worm disease, 551.

Bustard: natural enemy of the locust in Hungary, *p.* 1183.

CABBAGE: diseases observed in Belgium, *p.* 92.

Cabbage yellows parasite (*Fusarium conglutinans*) in relation to meteorological conditions in U.S.A., *p.* 378.

Calcium compounds as fungicides, 820.

Canada: Phytopathological laboratories, 173.

"Cancrena pedale" (*Phytophthora omnivora*) on pepper plant and melongena crops in the Campania, 127.

Canker: of the apple (*Nectria galligena*) in Belgium, *p.* 93; of the larch (*Dasyscypha Wilkommii*) in Belgium, *p.* 95. – *Nectria coffeigena*, "cancro do café", in Brazil, 647.

Capsicum: see Pepper plant.

Caratomus megacephalus in Spain, 129.

Carbon disulphide as an insecticide,

820; In the disinfection of cotton seed, 302.
Carbon tetrachloride, 820.
Carpocapsa pomonella, on apples in Denmark, 124.
Carrot: *Trioza viridula* in Jutland (Denmark), 124.
Celery: Leaf scorch (*Septoria Petroselini* var. *Apii*) in Belgium, *p.* 92.
Cembrus (*Pinus Cembra*): attacked by *Lophyrus similis* in Switzerland, 378.
Cephalosporium Acremonium, harmful to maize in U.S.A., 126.
Cercospora beticola on beetroot in Belgium, *p.* 91.
Cereals: Diseases observed in Belgium *p.* 89, *p.* 90. – Mildew (*Erysiphe graminis*) with relation to meteorological conditions in U.S.A., *p.* 379.
Ceroplastes rusci, *C. sinensis*, found respectively on fig and myrtle in Spain, attacked by *Tomocera californica*, 129.
Ceutorrhynchus quadridens, injurious to mangels in Denmark, 124.
Chaetophoma coffeicola on coffee in the State of São Paulo (Brazil), 647.
Chamaerops: Diseases, 368.
Cheimatobia boreata and *Ch. brumata* in Denmark, 124.
Chelidoptera (*Platycleis*) *albopunctata* (*Plat. grisea*) in Hungary, *p.* 475.
Cherry: attacked by grey blight, (*Sclerotinia cinerea*) in Belgium, *p.* 93.
Chestnut: exempt from attacks by *Endothia parasitica* in Belgium, *p.* 94. – Japanese Ch., *Coryneum* sp., in France, 373. – Gipsy moth *Liparis dispar* (= *Lymantria dispar*) in Switzerland, 139.
Chillies: see Pepper plant.
Chionaspis citri, injurious to acid fruits in Uruguay, 137.
Chloropicrin. 820.
Chlorops taeniopus on oats in Jutland, 124.
Chortophila brassicae in Denmark, 124.
Chrysomyxa Abietis, on spruce firs in Belgium, *p.* 95.
Cladosporium fulvum, on tomatoes in Belgium, *p.* 92; in Denmark, 124.
Clasterosporium coffeanum on Coffee in State of São Paulo (Brazil), 647.
Claviceps: *C. purpurea*, *pp.* 1107, 1131, 1132. – *C. purpurea* on rye in Belgium, *p.* 90. – *Claviceps* sp., *p.* 1114. – *C. purpurea* (ergot) on rye in Belgium, *p.* 90.
Clover: *Cuscuta minor* (dodder), *Gloeosporium caulivorum* (leafspot), *Erysiphe Polygoni* (mildew), *Peronospora Trifoliorum*, *Sclerotinia Trifoliorum* in Belgium, *p.* 91. – Legislative measures in Austria against dodder in C., 381. – Red C.: seeds and weed seeds, *p.* 1095.
Coccidae (*Ceroplastes sinensis*) in Spain 129. – British C., 649.
Coccus sp., injurous to beans in Costa Rica, 370.
Cockchafer: see *Melolontha vulgaris*.
Cockchafers: Legislative measures against C., in Austria, 381. – Control of C., in Lower Austria, 382.
Coconut palm: attacked by *Brassolis istmia* in Costa Rica, 134. – Attacked by "Mahali" disease in Malabar, 646. – Diseases of C. p. in Indo-China, 314. – *Phytophthora omnivora* var. *Arecae* in Malabar, 646. Diseases in Belgian Congo, 368.
Cocoa tree: *Brassolis istmia* in Costa Rica, 134. – Diseases, 368.
Coelogyne sp. attacked by *Lepidosaphes laterochitinosa* in Surrey (England), 649.
Coffee: Diseases in Belgian Congo, 368. – In the State of São Paulo, (Brazil), 647. – *Metadrepana andersoni* in Kenya, 376. – *Stephanoderes coffeae* in Brazil, 1011, 1013.
Colletotrichum: *C. incarnatum* on coffee, 647. – *C. Lindemuthianum* on beans in relation to meteorological

conditions, *p.* 379. – *C. Lind.* on beans in Belgium, *p.* 92.
Conferences : Imperial Entomological C. (London, 9-18 June 1925), 968. – First Pan-Pacific Food Conservation C., Honolulu (31 July-14 Aug. 1924), plant protection, 196.
Congresses : XII International C. of Agriculture, Warsaw (21-24 June 1925) : International organization of the control of plant diseases, 462. – XII international C. of Agriculture, Warsaw, (21-24 June 1925) : phytopathological questions, 711. – VII International C. of olive-growers, Seville (5-19 Dec. 1924) : Olive diseases, 191. – IX C. of Italian Olivegrowers, Bari), (19-21 oct. 1925, 969). – LX Pomological C., Angers, (Sept. 1924) : insects and cryptogamic diseases of the strawberry, 472. – World's Forestry Congress, Rome, (May 1926) : Forest plant diseases, 463. – International C. for study and protection of Birds, Luxemburg (13 April 1925), 464.
Conifer root rot (*Fomes annosus*) of Scots pine (*Pinus sylvestris*). in Belgium, *p.* 95.
" Convegno del Pesco " (Canale d'Alba 16-19 July 1925) : diseases of the peach tree and treatment, 972.
Copper Carbonate, 820. – C. C. powder against rot in wheat, 435.
Copper (compounds), 820.
Copper soap powder as a fungicide, 820.
Corchorus capsularis and *C. olitorius*: *Macrophoma Corchori* in India, 645.
Coryneum : *C. Beyerinckii* on peach in Belgium, *p.* 93. – *Coryneum* sp., injurious to Japanese chestnut in France, 373.
Costa Rica : *Bacterium* sp. and *Coccus* sp. injurious to beans, 370. – *Brassolis istmia* injurious to cocoa tree and other plants, 134.
Cotton : " Arrebatada " and wilt in Peru, 56. – Boll weevil and pink bollworm (" lagarta rosada ") unknown in Peru, 56. – Insects injurious to c. in Nyasaland, 1016. – Disinfection of c. seeds with carbon disulphide, 302. – Diseases of c., 368. – *Macrophoma Corchori*, 645. – Measures of control in Argentina against pink bollworm (" lagarta rosada ") *Gelechia gossypiella*, 140 – Sore-shin disease, (*Rhizoctonia Solani*) in relation to meteorological conditions in Egypt, *p.* 374.
Cricket-bat willow (*Salix caerulea*), 644.
Cronartium ribicolum, pine rust destroying Weymouth pine in Belgium, *p.* 95.
Cruciferae (edible) : *Meligethes aeneus* in Denmark, 124.
Cuba : Diseases and insects of sugar cane, 904. – Endowments for promotion of studies re " mosaic " of sugar cane, 678. – Tachinid from Cuba introduced into Louisiana (U.S.A.) experimental Sugar plantations to combat moth borer, 903.
" Cube ", 820
Cucumbers : " Mosaic " in relation to meteorological conditions, *p.* 379. – *Oidium* on C. in India, in relation to meteorological conditions, *p.* 374.
Cultures : Collection of type c. of bacteria of the American Museum of Natural History transferred to McCormick Memoriai Institute of Chicago, 909.
Currant bush : attacked by American gooseberry mildew (*Sphaerotheca mors-uvae*) in Belgium, *p.* 94 – Leaf spot (*Pseudopeziza Ribis*) in Belgium, *p.* 94. – *Nematus ribesii* in Denmark, 124.
Cuscuta : *C. arvensis*, *p.* 1118. – *C. arvensis*, *C. racemosa*, *C. Trifolii*,

p. 1175. – *C. arvensis* var. *calycina*, *p.* 1115, *p.* 1118. – *C. minor* on clover in Belgium, *p.* 92. – *C.* sp., *p.* 1130. – *C. Trifolii*, *p.* 1115, *p.* 111, *p.* 1130. – *C. Trifolii*: Legislative measures in Austria, 381.

Cyprus (Isle of) : *Thaumetopoea wilkinsoni* injurious to pines, 379.

Cyrenaica : Locusts, *p.* 787. – *Franklinothrips myrmicaeformis* on vines, near Bengasi, 136. – Orthoptera in Bengasi, 648. – Date-palms: *Mauginiella Scaettae*, 372.

Cytospora: *C. chrysosperma* on *Salix caerulea* in England, 644. – *C. purpurescens* injurious to plum in Belgium, *p.* 93.

Cytosporina coffeicola on coffee, 647.

DACUS OLEAE: observations re *D. o.* at 9th Congress of Italian Olive growers (Bari, Oct. 1925), 969. – Control of *D. o.*, in Turkey *p.* 484; in Portugal 132; in Spain, 133. – Study of methods used for control in Portugal, 131.

" Damping off ", 645.

Dasyscypha Willkommii on larches in Belgium, *p.* 95.

Date palm: *Mauginiella Scaettae* in Cyrenaica, 372.

Decticus albifrons in Bengasi (Cyrenaica), 648.

Degeneration of the potato in Belgium, *p.* 90, *p.* 91.

Delphinium Consolida used in preparation of insecticide powders, 820.

Denmark : Plant diseases and pests, 124.

Derris elliptica used in preparation of insecticide powders, 820.

Dianthus : *Hylemyia cardui* and *Thrips* sp. in Denmark, 124.

Diaspis pentagona: Measures for cheking its spread in Algeria, 398.

" Die-back " of chillies (*Vermicularia Capsici*), in relation to meteorological conditions in India, *p.* 371.

Diparopsis castanea, cotton pest, in Nyasaland, 1016.

Diplodia coffeicola on coffee, 647.

Disinfection of cotton seed with carbon disulphide, 302.

Dociostaurus (*Stauronotus*) *brevicollis*, *D. cruciatus* and *D. maroccanus* in Hungary, *p.* 473.

Dodder: *p.* 1163. – Clover d.. (*Cuscuta minor*) in Belgium, *p.* 92, – D. in Austria, 381. – Legislative measures in Austria, 380. – Report of D. Committee, *p.* 1175. – State supervision of forage crops in Roumania to ensure destruction of d., 890.

Doryphora decemlineata: legislation in Belgium against this insect, *p.* 98.

Dust treatment for control of Oat Smut (*Ustilago Avenae* and *U. levis*), 642.

EGG collection as a means of locust control in Iraq, *p.* 1183.

Egypt: Locusts, *p.* 484. – Sore-shin disease of cotton (*Rhizoctomia Solani*) in relation to meteorological conditions, *p.* 374.

" Eel-worm disease " of bulbs, 551.

Elaeis: diseases, 368.

Elateridae larvae in soils, *p.* 1075.

Elm : attacked by sclerosis in Belgium, *p.* 94.

Emberiza citrinella natural enemy of *Tettigonia albifrons* in Bengasi (Cyrenaica), 648.

Empusa Gryllli on locusts in Hungary, *p.* 468, *p.* 469, *p.* 477.

Endothia parasitica not observed on chestnuts in Belgium, *p.* 94.

England : *Cytospora chrysosperma* on *Salix caerulea*, 644. – *Erysiphaceae* in relation to meteorological conditions, *p.* 373. – *Phytophthora infestans* in relation to meteorol-

ogical conditions, *p.* 372. – *Salix caerulea* attacked by *Bacterium Salicis*, 644. – Varieties of potatoes immune or susceptible to wart disease (*Synchytrium endobioticum*) 838.

Entomology: Biographical dictionary of E., proposed, 251.

Erica Tetralix: *Lepidosaphes ulmi* in England, 649.

Eriococcus hoheriae on *Hoheria populnea* in the Scilly Isles (Great Britain), 649.

Eritrea (Colony of): Locusts, *p.* 383.

Erysiphaceae in relation to meteorological conditions in England, *p.* 369, *p.* 373.

Erysiphe: *E. Cichoriacearum* on tobacco in relation to meteorological condition in U. S., *p.* 379. – *E. graminis* on wheat in relation to meteorological conditions in Italy, *p.* 373. – *E. Polygoni* in relation to meteorological conditions in India, *p.* 373. – *E. P.*, on cabbages, turnips and mangels in Belgium, *p.* 92. – *E. P.* on clover in Belgium, *p.* 92.

Euproctis chrysorrhoea, 131.

Exosporium Preslii, on *Phoenix* leaves in Denmark, 124.

" FERTILISA de Pion-Gan ", fungicide used in treatment of seeds in Switzerland, 435.

Festuca elatior: *Apamea testacea* in Denmark, 124.

Field and Forest plant diseases in Belgium and Belgian Congo, 368.

Ficus Carica: *Ceroplastes rusci* found on *F. C.* in Spain, and attacked by *Tomocera californica*, 129.

Fig: see *Ficus Carica*.

" Finger-and-toe " (*Plasmodiophora Brassicae*) of cabbage, in Belgium, *p.* 92.

Firs: mortality in the Wienerwald, *p.* 155, *p.* 156.

Flax: *Asterocystis radicis* in Belgium, *p.* 92. – *Fusarium Lini* in relation to meteorological conditions in U. S. A., *p.* 378.

Fomes annosus on Scots pine in Belgium, *p.* 95.

Forests: Control and protection of F. in Spain, 651.

France: Japanese Chestnut attacked by *Coryneum* sp., 373.

Franklinothrips: *Fr. myrmicaeformis* on vines in Cyrenaica, 136. – *Fr. tenuicornis* and *Fr. vespiformis*, 136.

French Oceania: measures for protection of plants against parasitic diseases, 659.

Fruit bushes: diseases in Belgium, *p.* 94.

Fungicides: Recent progress, 820.

Furfural: direct utilization for fungicides and insecticides, 107, 108.

Fusarium spp., *F. coffeicola* on coffee, 647. – *F. conglutinans* in relation to meteorological conditions in U. S. A., *p.* 378. – *F. Lini* on flax in U.S.A., in relation to meteorological conditions, *p.* 378. – *F. Lycopersici* on tomato in U.S.A., in relation to meteorological conditions, *p.* 378. – *F. oxysporum* and *F. radicicola* on potato in U.S.A., in relation to meteorological conditions, *p.* 378. – *F. oxyysporum* var. *Nicotianae* on tobacco in relation to meteorological conditions in U.S.A., *p.* 378. – *F.* sp., 125, *p.* 90. – *F.* sp., on melongena and pepper plants in the Campania, 127. – *F.* spp., injurious to vegetables in Denmark, 124. – *F.* spp., on potato in Belgium, *p.* 91. – *F. Willkommii* (conidial state of *Nectria galligena*), injurious to apples and pears in Denmark, 124.

" GAFA " (*Dacus oleae*, *Gloeosporium olivarum*), 132.

Ganges: Potato blight (*Phytophthora*

infestans) in the Gangetic Plain, in relation to meteorological conditions, *p.* 371.

Gelechia gossypiella: legislative measures in Argentina against this insect, 140.

Germany: *Ampelopsis Veitchii* attacked by Vine mildew (*Plasmopara viticola*) in Rheingau, 128.

Gibberella Saubinetii on wheat and maize in relation to meteorolog-gical conditions in U.S.A., *p.* 377.

Gipsy Moth (*Lymantria dispar*) injurious to Chestnut in Switzerland, 139.

Gloeosporium: *G. album* injurious to apples in Denmark, 124. – *G. caulivorum*, injurious to clover in Belgium, *p.* 92. – *G. olivarum* (" Gafa ") injurious to olives in Portugal, 131, 132. – Research work re *G. o.*, proposed by 7th International Congress of Olive growers, Seville, Dec. 1924, 191.

Glomerella: *G. coffeicola* on coffee in the State of São Paulo, Brazil 647. – *G. Lindemuthiana*, injurious to beans in Denmark, 124.

Gnomonia leptostyla on Walnut in Belgium, *p.* 94.

Graminaceae: *Aphis fitchii* in Denmark, 124.

Grape mildew (*Plasmopara viticola*) in Germany, 128; in Belgium, *p.* 94.

Graphiola Phoenicis, on *Phoenix* leaves, in Denmark, 124.

Great Britain: British Coccidae, 649.

Growth reactions of certain fungi with reference to their excretory products, 125.

Guignardia Bidwellii in relation to meteorological conditions, *p.* 373.

Gummosis leaf disease of Peach, (*Coryneum Beyerinckii*) in Belgium, *p.* 93.

Gymnosporangium Sabinae, on pears in Belgium, *p.* 93.

HALTICIDAE, 124.

Heart rot of Beetroot (*Sphaerella tabifica*) in Belgium, *p.* 91.

Helianthemum vulgare: *Lepidosaphes ulmi* in England, 649.

Helminthosporium teres var. *Avenae* on oats in Belgium, *p.* 90.

Hendersonia coffeicola on coffee in State of São Paulo, Brazil, 647.

Hepialidae larvae in soils, *p.* 1075.

Heterodera: *H. radicicola*, injurious to the vine, 135. – *H. schachtii* var. *avenae*, on oats in Denmark, 124.

Heterosporium Allii, on leeks in Denmark, 124.

Hevea brasiliensis: Diseases, 368; in Indo-China, 316.

" Hielo " (ice) disease of bean crops caused by *Bacterium* sp. and *Coccus* sp., in Costa Rica, 370.

" Hill selection " method employed in N. York State to obtain clean seed potatoes, 42.

Hoheria populnea: *Eriococcus hoheriae* in the Scilly Isles (Great Britain), 649.

Holland: Legislation for protection of plants, 404.

Hoplocampa fulvicornis and *H. testudinea*, on apples, pears and plum in Denmark, 124.

Hops: *Apiosporium* sp. and mildew (*Sphaerotheca Humuli*) in Belgium, *p.* 92.

Howardia citri (= *Chionaspis citri*), 137.

Hungary: Locusts during 1924, *p.* 468–*p.* 482.

Hydrocyanic acid, 820. – H. a. as a toxic agent to plant growth, 827.

Hylemyia: *H. cardui* on *Dianthus* plants in Denmark, 124. – *H. coarctata* on wheat in Denmark, 124.

Hypochnus Solani, injurious to beetroot in Denmark, 124. – *H. S.*, on potato in Belgium, *p.* 91.

IMPURITIES (the presence of) as a mean of determination of place of origin of seeds, *p.* 1135.

" Index method " for elimination of mosaic and leaf-roll in potatoes, in U. S. A., 42.

India : Bunt of wheat (*Tilletia Tritici* and *T. levis*) in relation to meteorological conditions, *p.* 376. – " Die-back " of chillies (*Vermicularia Capsici*) in relation to meteorological conditions, *p.* 371. – Jute and other plants injured by *Macrophoma Corchori*, 645. – *Leucopis* (*Neoleucopis*) *luteicornis* as a parasite of *Phenacoccus iceryoides* in Coimbatore, 130. – Pea mildew (*Erysiphe Polygoni*) in relation to meteorological conditions, *p.* 373. – Rust of wheat (*Puccinia glumarum*, *P. triticina*) and meteorological conditions *p.* 370. – Smut of sorghum (*Sphacelotheca Sorghi*) in relation to meteorological conditions, *p.* 376. – Tobacco mildew (*Erysiphe Cichoriacearum*) in relation to meteorological conditions, *p.* 374. *Tylenchus angustus* on rice, in relation to meteorological conditions, *p.* 375. – *Ustilago Zeae* on maize, in relation to meteorological conditions, *p.* 377.

Indo-China : Diseases of coconut palm 314. – Diseases of *Hevea brasiliensis*, 316.

Insecticides : Some chemical problem of the ins. industry, 821. – Recent progress in ins., 820.

Insects and other invertebrate fauna of arable land at Rothamsted, *p.* 1075.

International Committee of Phytopathology and Economic Entomology, 440.

Iraq : Locusts, *p.* 1182.

Isobremia kiefferi parasite on aphides, 374. – Infested by *Synopeas rahnis*, in Jugoslavia, 374. – *I. sonchi*, external parasite of *Aphis sonchi*, 374.

Italian cricket and Moroccan locust in Hungary during 1924, *p.* 468 – *p.* 477.

Italy : Algerian regulations re importation of plants from I., 398. – *Erysiphe graminis* on wheat in I., *p.* 373. – Insects injurious to forest plants in I., 138. – Melongena crops and pepper plant in Campania attacked by *Phytophthora omnivora*, *Fusarium* sp. and a Nematode, 127. – Phylloxera of the vine and its spread in I., 973.

JAMAICA : Immunity of Uba sugar cane from " mosaic ", 246.

Jugoslavia : *Isobremia kiefferi* n. sp., a parasite on Aphides, 374.

« Jurubeba » (*Solanum paniculatum*) attacked by *Phthorimaea operculella* in Brazil, 377.

Jute (*Corchorus capsularis*) : *Macrophoma Corchori* in India, 645.

" KANRED " (Wheat) and stem-rust resistance, 831.

Kenya : *Metadrepana andersoni* injurious to coffee, 376.

« Koleroga » (or " Mahali "), betel nut disease in Malabar, Canara and Maipur, 646.

Kuwania pini on Scots pine (*Pinus sylvestris*) in Surrey, Great Britain, 649.

LACHNEA HEMISPHAERICA on coffee in the State of São Paulo, Brazil, 647.

" Lagarta rosada " of cotton, or Pink bollworm (*Gelechia gossypiella*=*Pectinophora gossypiella*) : Legislative measures in Argentina, 140.

Larch : attacked by canker (*Dasyscypha Wilkommii*) in Belgium, *p.* 95.

Latvia: control of seed for sowing with reference to diseases (*Puccinia, Ustilago*), 147.
Laurus nobilis: *Aspidiotus britannicus* in Great Britain, 649.
Lead compounds in the manufacture of insecticides, 820.
"Leaf blister" on peaches (*Taphrina deformans*) in Belgium, *p.* 93.
Leaf blotch (*Ascochyta piniperda*) of the spruce in Belgium, *p.* 95. – L. spot (*Pseudopeziza Ribis*) of the currant bush in Belgium, *p.* 94.
Leaf-roll, on potatoes, 41; in Belgium, *p.* 91. – in Denmark, 124.
Leaf-spot (*Gloeosporium caulivorum*), on clover in Belgium, *p.* 92.
Lecanium persicae on *Tamarix* in Great Britain, 649.
Leeks: *Heterosporium Allii* in Denmark 124.
Lemon: *Chionaspis citri* (= *Howardia citri*) in Uruguay, 137.
Lepidosaphes laterochitinosa parasite found on *Coelogyne* sp., in Surrey, England, 649. – *L. ulmi* on *Helianthemum vulgare* and *Erica Tetralix* in Surrey, England, 649.
Leptosphaeria culmifraga on wheat in Belgium, *p.* 89.
Leucopis (*Neoleucopis*) *luteicornis*, 130.
Liparis dispar: see *Lymantria dispar*.
Locusta danica in Hungary, *p.* 475, *p.* 482.
Locusts: in Cyrenaica, *p.* 787.; in Egypt, *p.* 484; in Hungary in 1924, *pp.* 468-482; in the Colony of Eritrea, *p.* 483; in Italian Somaliland, *p.* 483, *p.* 484; in Tripoli, *p.* 788; in Iraq, *p.* 1182. « Moroccan Cricket » in Hungary in 1924, *pp.* 468-476. – Locusts in stock feeding, 86. – International organization for l. control, *p.* 1189.
Lophodermium: *L. macrosporum* on spruce firs in Belgium, *p.* 95. – *L. Pinastri* on Scots pine in Belgium, *p.* 95.
Lophyrus similis injurious to Cembrus pines in Switzerland, 378.
Louisiana (U.S.A.): Sugar Cane attacked by moth borer and mealy bug, 903.
Lucerne (trefoil): *Biston zonarius* in Denmark, 124. – Determination of the country of origin of clover and forage crop seed, *p.* 1095.
Lymantria dispar injurious to chestnuts in Switzerland, 139.

Macrophoma: *M. Corchori* injurious to jute and other plants in India, 645. – *M. dalmatica*: Research work for control of pest proposed by VII International Congress of Olive growers, Seville, Dec. 5-9, 1924, 191.
Macrosiphum: *M.* (*Aphis*) *rosae* and *M. sonchi* attacked by *Isobremia kiefferi* in Jugoslavia, 374. – *M. pisi* injurious to vegetables in Denmark, 124.
Macrosporium Pisi, 124.
« Mahali » (or « Koleroga »), coconut palm disease in Malabar, 646. – Betel nut disease in Malabar, Canara and Maipur, 646.
Maize: *Cephalosporium Acremonium* in U. S. A., 126. – *Gibberella Saubinetii* in relation to meteorological conditions in U.S.A., *p.* 377. – *Sclerotium monohistum* in Morocco, 369. – *Ustilago Zeae* in relation to meteorological conditions in India, *p.* 377.
Malabar: *Phytophthora omnivora* var. *Arecae* injurious to coconut palm and betel nut, 646.
Malay States: Mycological and Entomological Services of Department of Agriculture, 184. – Pests and diseases of rice, 47.
Mamestra pisi, insect pest injurious to peas in Roumania, *p.* 692.

Mandarins : *Chionaspis citri* (= *Howardia citri*) in Uruguay, 137.
Manganese chlorosis of Pineapples, its cause and control, 819.
Mangels : *Ceutorrhynchus quadridens* and *Meliggthes aeneus* in Denmark, 124. – Diseases observed in Belgium, *p*. 92.
Marssonina Potentillae var. *Fragariae* on strawberries in Denmark, 124.
Mauginiella Scaettae injurious to date-palms in Cyrenaica, 372.
Mealy Bug (*Pseudococcus calceolariae*) on sugar cane in Louisiana, U. S. A., 903.
Melampsora pinitorqua on *Pinus sylvestris* in Belgium, *p*. 94, *p*. 95.
Meligethes aeneus injurious to mangels and other edible Cruciferae in Denmark, 124.
Melolontha vulgaris, injurious to beans in Roumania, *p*. 690. – Government campaign against *M. v.*, in Austria, 382.
Melon : *Phyllosticta cucurbitacearum* in Denmark, 124.
Melongena crops : attacked by *Fusarium* sp., a Nematode and *Phytophthora omnivora* in the Campania, 127.
Mercury in the composition of fungicids, 820.
Mermis sp., in strawberies in Denmark, 124.
Metadrepana : *M. andersoni* injurious to coffee in Kenya, 376. – *M. pallida* found in Northern Nigeria, 376.
Meteorological conditions and plant diseases, *p*. 369.
Microsphaera Alni var. *quercina*, on the Oak in Belgium, *p*. 94.
Mildew : Of the Apple (*Podosphaera leucotricha*) in Belgium, *p*. 93. – Of apple in relation to meteorological conditions in Wurtemberg, *p*. 373. – M. on beetroot (*Peronospora Schachtii*) in Belgium, *p*. 91. – Of cabbages, turnips and mangels, (*Erysiphe Polygoni*) in Belgium, *p*. 92. – Of cerales (*Erysiphe graminis*) in relation to metorological conditions in U.S.A., *p*. 379. – Of Clover (*Sclerotinia Trifoliorum*) in Belgium, *p*. 92. – M. of clover (*Peronospora Trifoliorum*) *p*. 92. – Of the currant bush (*Sphaerotheca Mors-Uvae*) in Belgium, *p*. 94. – Legislation in Belgium re control of *Sph. Mors-Uvae* on currant bush *p*. 98. – M.on potato in England, *p*. 372. – In Belgium, *p*. 92. – M. on potato in relation to meteorological conditions, *p*. 379. – In India, *p*. 376. – In the Gange plain, *p*. 370. – Of the oak in relation to meteorological conditions, *p*. 373. – Of the oak (*Microsphaera Alni* var. *quercina*) in Belgium, *p*. 94. – Of peas (*Erysiphe Polygoni*) in India, in relation to meteorological conditions, *p*. 373. – Of tobacco (*Erysiphe Cichoriacearum*) in relation to meteorological conditions in India, *p*. 374. – M. on tomato in Belgium, *p*. 92. – M. of the vine (*Plasmopara viticola*) in relation to meteorological conditions, *p*. 373. – In Belgium, *p*. 94. – On *Ampelopsis Veitchii* in Germany, 128.
Moth borer, injurious to Sugar Cane in Louisiana, U.S.A. : Experiments with natural and artificial remedies, 903.
Morocco : Maize attacked by *Sclerotium monohistum*, 369. – Sugar Beet attacked by *Sclerotium* sp., 379.
Mortality of Firs in the Wienerwald, *p*. 155, *p*. 156.
« Mosaic » : Of beetroot in Denmark, 124. – Of cucumbers and various mosaic diseases, in relation to meteorological conditions in U.S.A., *p*. 379. – Of the potato, 42 ; In Denmark, 124 ; in Belgium, *p*. 91. –

Of Sugar cane: immunity of « Uba » cane in Jamaica, 246. – « Uba » cane in Brazil, 898. – M. of tobacco in Belgium, *p.* 92.

« Mosca da azeitona » (*Dacus oleae*) 132.

Moth Borer of Sugar Cane (*Diatraea saccharalis*) in Louisiana, U.S.A., 903.

" Mottling " disease on potatoes in Belgium, *p.* 91.

Mould: of the apple (*Sclerotinia fructigena*) in Belgium, *p.* 93. – Grey blight (*Sclerotinia cinerea*) on cherries, in Belgium, *p.* 93. – Grey mould (*Sclerotinia Fuckeliana*) on vine, in Belgium, *p.* 94.

Mycosphaerella sentina on pear in Belgium, *p.* 93.

Myrtus communis: *Ceroplastes sinensis* (attacked by *Tomocera californica*) found on *M. c.* in Spain, 129.

Myrtle: see *Myrtus communis*.

Myzus rosarum attacked by *Isobremia kiefferi* in Jugoslavia, 374.

NATURAL enemies of locusts, *p.* 1183.

Necrosis of the branches of plum tree (*Cytospora purpurascens*) in Belgium, *p.* 93.

Nectria: *N. coffeigena* on coffee in State of São Paulo (Brazil), 647. – *N. galligena*, on apples in Belgium, *p.* 93. – See also *Fusarium Willkommii*, – *N. Solani*, on potato in Belgium, *p.* 91.

« Nejdi »: local name for locusts in Upper Iraq, *p.* 1183.

Nematode injurious to pepper plant and melongena in the Campania, 127.

Nematus ribesii, injurious to currant bushes in Denmark, 124.

Nerine flexuosa: *Pseudococcus* (*Trionymus*) *peregrina*, found near Southampton, England, 649.

Nicotine, 820.

Nigeria (Northern): *Metadrepana pallida*, 376.

Nyasaland: Measures for control of diseases of plants, 146. – Insect pests injurious to cotton, 1016.

OAK: Mildew in relation to meteorological conditions, *p.* 373. – *Microsphaera Alni* var. *quercina* in Belgium, *p.* 94.

Oats: Smut (*Ustilago Avenae*), *Helminthosporium teres* var. *Avenae*, Crown rust (*Puccinia coronifera*) and black rust in Belgium, *p.* 90. – *Chlorops taeniopus*, *Heterodera schachtii* var. *avenae*, *Oscinis frit* in Denmark, 124. – *Puccinia coronifera* in relation to meteorological conditions in U.S.A., *p.* 379. – Dust treatment for control of O. smut (*Ustilago Avenae* and *U. levis*), 642.

Oceania (French): measures for protection of plants against parasitic diseases, 659.

Ochthiphila polystigma, natural enemy of *Pseudococcus* (*Trionymus*) *phalaridis*, found at Frimley, Surrey, (England), 649.

Oidium: *O.* of cucumber, strawberry and vine in relation to meteorological conditions in India, *p.* 374. – Of hop (*Sphaerotheca Humuli*) in Belgium, *p.* 92. – Of peach tree in Belgium, *p.* 93. – *O.* spp. in relation to meteorological conditions, *p.* 374. – *O.* of the vine (*Uncinula necator* or powdery mildew) in Belgium, *p.* 94.

Olea europaea: *Amblymerus maculipennis*, found in Spain, 129.

Olethreuthes ocellana on apples in Denmark, 124.

Olive: *Bacillus Savastanoi* (bacterial tumour of the o.) in Portugal, 131. – Diseases of the O., reports at VII International Congress of O. growers, Seville (Spain), Dec.

1924, 191. – O. fly (*Dacus oleae*) control in Turkey, *p.* 484, *p.* 485. – *Gloeosporium olivarum* in Portugal, 131. – Observations on *Phloeothrips oleae* and *Dacus oleae* at IX Congress of Italian Olive growers, Bari, Oct. 1925, 969. – *Prays oleaellus* in Portugal, 131. – Study of methods used for control of *Dacus oleae* in Portugal, 131.

Olive Fly (*Dacus oleae*): Control in Cenia (Spain) 133. – Control in Turkey *p.* 484, *p.* 485. – Control in Portugal, 131, 132. – Observations re O. F., at XI Congress of Italian Olive growers, Bari, Oct. 1925, 969. – See also *Dacus oleae.*

Omphalia flavida, on coffee, 647.

Onion: Smut (*Urocystis Cepulae*) in relation to meteorological conditions in U. S. A., *p.* 378.

Ophiobolus graminis on wheat in Belgium, *p.* 89.

Orange: *Chionaspis citri* (= *Howardia citri*) in Uruguay, 137. – *Protapanteles marquesi,* a parasitic hymenopteron of *Papilio anchisiades capys,* injurious to O. in Brazil, 375.

Orphania denticauda, locust in Hungary, *p.* 474. – *Orphania, p.* 482

Orthoptera in Bengasi (Cyrenaica), 648.

Oscinis frit on oats in Jutland, 124.

PACHYTYLUS CINERASCENS, P. danicus: locusts in Hungary, *p.* 475.

Palms: diseases, 368.

Papilio anchysiades capys, attacked by *Protapanteles marquesi* in Brazil, 375.

Pea: *Aphis viciae, Bruchus pisi, Mamestra pisi, Peronospora Viciae, Plusia gamma, Uromyces Pisi,* in Roumania, *p.* 691, *p.* 692. – *Erysiphe Polygoni* in relation to meteorological conditions in India, *p.* 373.

Peach: Diseases and treatment discussed at « Convegno del Pesco » Canale d'Alba, July 1925, 972. – Gummosis leaf disease (*Coryneum Beyerincki*) and leaf blister (*Taphrina deformans*) in Belgium, *p.* 94. – Oidium in Belgium, *p.* 94.

Pear tree: *Hoplocampa fulvicornis* and *H. testudinea* in Denmark, 124. – Leaf mildew (*Mycosphaerella sentina*), P. leaf cluster-cup (*Gymnosporangium Sabinae*), scab (*Venturia pirina*) in Belgium, *p.* 93.

Pears: *Fusarium Willkommii* (*Nectria galligena*) in Denmark, 124.

Pepper plant: " Die back " (*Vermicularia Capsici*) in relation to meteorological conditions in India, *p.* 371. – *Fusarium* sp., Nematodes and *Phythophthora omnivora* in the Campania, 127.

Peronospora : P. Trifoliorum on clover in Belgium *p.* 92. – *P. Viciae* injurious to peas in Roumania, *p.* 692. – See also: Mildew.

Peronosporaceae: see Mildew.

Peru: Boll weevil (*Anthonomus grandis*), " lagarta rosada " or Pink Bollworm, not found on cotton, 56.

Pestalozzia coffeicola on Coffee in State of São Paulo, Brazil, 647.

Phalaris arundinacea: attacked by *Pseudococcus* (*Trionymus*) *phalaridis,* found at Frimey, Surrey, England, 649.

Phenacoccus iceryoides attacked by *Leucopis* (*Neuleucopis*) *luteicornis* in Coimbatore, India, 130.

Phloeothrips oleae: New data on biollogy of *Ph. o.*, at 9th Congress of Italian Olive growers Bari, Oct. 1925, 969.

Phoenix : P. dactylifera : Mauginiella Scaettae in Cyrenaica, 372. – *Exosporium Preslii* and *Graphiola Phoenicis* in Denmark, 124. – Disesaes, 368.

Phorbia fuscipennis (" seed-corn maggot ") agent of dissemination of

potato "blackleg" in Minnesota, 643.

Phthorimaea operculella, "potato moth" on tobacco, in Brazil, 377.

Phyllosticta: *P. Betae* on beetroot in Belgium, *p.* 91. – *P. Cucurbitacearum*, injurious to melons in Denmark, 124. – *P. prunicola* on plum tree in Belgium, *p.* 93.

Phyllotreta nemorum, in Denmark, 124.

Phylloxera: Ph. and its spread in Italy, 973; in Russia, *p.* 363; in Roumania (1884-86) *p.* 37.

Phytobacter Lycopersicum on tomato in Belgium, *p.* 92.

Phytopathological legislation in Belgium, *p.* 97.

Phytopathological organization in Belgium, *p.* 95.

Phytopathological research institutions in Belgium, *p.* 95-*p.* 98.

Phytophthora: *P. infestans* injurious to potatoes in Belgium, *p.* 90. – Injurious to tomato in Denmark, 124. – In relation to meteorological conditions in England, *p.* 369, *p.* 372; in the Ganges plain, India, *p.* 371. – *P. omnivora* injurious to melongena crops and pepper plant in the Campania, 127. – *P. omnivora* var. *Arecae* cause of "Mahali" (or "Koleroga") disease in betel nut, 646. – *P. o.* var. *Arecae* injurious to coconut palms in Malabar, 646.

Pine: P. in Cyprus injured by *Thaumetopoea wilkinsonii*, 379. – *Pinus sylvestris* (Scots pine): pine branch twist (*Melampsora pinitorqua*), pine leaf cast (*Lophodermium Pinastri*), conifer root rot (*Fomes annosus*), root rot (*Armillaria mellea*) in Belgium, *p.* 94, *p.* 95. – Weymouth p.: pine rust (*Cronartium ribicolum*) in Belgium *p.* 95.

Pine apple: Manganese chlorosis, its cause and control, 819.

Pine leaf cast (*Lophodermium Pinastri*) on Scots pine in Belgium, *p.* 94.

Pink Bollworm ("lagarta rosada"), 56.

Pinus: *P. Cembra* attacked by *Lophyrus similis* in Switzerland, 378. – *P. sylvestris* attacked by *Kuwania pini* in Surrey, England, 649.

Pistillaria flavida on coffee, 647

Plants: (Agricultural crops): diseases observed in Belgium, *p.* 89; in Belgium and Belgian Congo, 368. – (Forage crops): diseases in Belgium, *p.* 91. – Plants (Forest): Noxious insects in Italy, 138. – (Industrial): diseases observed in Belgium, *p.* 92. – (Market garden): diseases in Belgium, *p.* 92. – (Roots): diseases in Belgium, *p.* 90.

Plasmodiophora Brassicae on cabbage, turnip, and mangel, in Belgium, *p.* 92.

Plasmopara viticola: in relation to meteorological conditions, *p.* 373, *p.* 379. – *P. v.* on *Ampelopsis Veitchii* in Germany, 128. – *P. v.*, on vine in Belgium, *p.* 94.

Platycleis grisea, *p.* 475. – *Platycleis*, *p.* 480, *p.* 481.

Pleospora: *P. graminea* on barley in Denmark, 124. – *P. putrefaciens* on beetroot in Belgium, *p.* 91. – *P. trichostoma* on barley in Belgium, *p.* 90.

Ploughing as a method of locust control in Iraq, *p.* 1184.

Plum: Blister disease (*Taphrina Pruni*) in Belgium, *p.* 93. – *Hoplocampa fulvicornis* and *H. testudinea* in Denmark, 124. – Necrosis of the branches (*Cytospora purpurascens*) in Belgium, *p.* 93. – *Polyporus igniarius* var. *fulvus* in Belgium, *p.* 93. – *Phyllosticta prunicola* (leaf brown) in Belgium, *p.* 93. – *Puccinia Pruni-spinosae* (blight) in Belgium, *p.* 93. — Witch's broom disease, (*Taphrina Insititiae*) in Belgium, *p.* 93.

Plusia gamma, injurious to peas in Roumania, *p.* 692.

Podosphaera leucotricha, on the apple in Belgium, *p.* 93.

Polyporaceae on walnut in Belgium, *p.* 94.

Polyporus igniarius var. *fulvus* on plum tree in Belgium, *p.* 93.

Potato : *Bacillus phytophthorus*, cause of p. " blackleg ", disseminated by *Phorbia fuscipennis* in Minnesota, U.S.A., 643. - *Bac. phytoph.* in Belgium *p.* 90. – Bacterial diseases in Belgium, *p.* 90. – Bacterial scab in Belgium, *p.* 91. – Blackleg disease in Belgium *p.* 91. – Black scurf, scab, and wilt, 42. – Collar fungus (*Hypochnus Solani*) in Belgium, *p.* 91. – Control of wart disease by soil treatment with use of sulphur, *p.* 1061. – Diseases in Belgium and Belgian Congo, 368. – *Fusarium* sp., in Belgium, *p.* 91. – *Fusarium oxysporum* and *F. radicicola* in relation to meteorological conditions in U. S. A., *p.* 378. – Leaf curling in Belgium, *p.* 91. – " Leaf roll " and " Mosaic ", *p.* 42. – " Leaf roll " and " mosaic " in Denmark, 124. – Legislative measures in Austria against black scab, 381. – *Macrophoma Corchori*, 645. – " Mosaic ", 42. – M. in Belgium, *p.* 91 ; in Denmark, 124. " Mottling " in Belgium, *p.* 91. – – *Nectria Solani* in Belgium, *p.* 91. – *Phytophthora infestans* in Belgium, *p.* 90. -- *Phy. inf.* in relation to meteorological conditions in England, *p.* 369 ; in the mid-Gangetic plains, *p.* 371. – P. blight in relation to meteorological conditions, *p.* 371, *p.* 379. – Powdery scab (*Spongospora subterranea*) in Belgium, *p.* 91. Seed P. improvement methods in Michigan and New York State, 42. – " Streaking " in Belgium *p.* 91. – Varieties immune from black scab, 520. – Varieties in England immune from or susceptible to Wart disease (*Synchytrium endobioticum*), 838. – *Verticillium albo-atrum* in relation to meteorological conditions in U. S. A., *p.* 378 ; in Belgium, *p.* 91.

" Potato Blackleg " (*Bacillus phytophthorus* disseminated by *Phorbia fuscipennis* in Minnesota, U.S.A., 643.

Potato Moth (*Phthorimaea operculella*) found on tobacco in Brazil, 377.

Portugal : *Bacillus Savastanoi* (Bacterial tumour of the Olive), 131. – *Dacus oleae* (Olive fly), 131. – Control of the Olive fly, 132. – *Gloeosporium olivarum*, 131. – *Prays oleaellus*, 131.

Prays oleaellus of the olive in Portugal, 131.

Protapanteles marquesi, parasite of *Papilio anchisiades capys* in Brazil, 375.

Pseudococcus : *P.* (*Trionymus*) *peregrina* found on *Nerine flexuosa* near Southampton, England, 649. – *P.* (*Trionymus*) *phalaridis* living on *Phalaris arundinacea*, found at Frimley, Surrey, England, 649.

Pseudomonas campestris, on cabbages, turnips and mangels in Belgium, *p.* 92.

Pseudopeziza Ribis (Leaf spot) injurious to currant bushes in Belgium, *p.* 94.

Puccinia : *P.* and seeds in Latvia, 147. – *P. coronifera* on oats in Belgium, *p.* 90. – *P. c.*, on oats in relation to meteorological conditions in U.S.A.. *p.* 379. – *P. dispersa*, *P. glumarum*, and *P. graminis* on rye in Belgium, *p.* 90. – *P. glumarum*, *P. graminis*, and *P. triticina* on wheat in Belgium, *p.* 89, *p.* 90. – *P. glumarum* and *P. triticina* in India in relation to meteorological conditions, *p.* 370. – *P. graminis* on wheat in relation to meteorological condi-

tions in U.S.A., *p.* 379. – *P. graminis*: inheritance of resistance to *P. graminis*, in crosses between varieties of Durum wheat, 833. – *P. Pruni-spinosae* on plums in Belgium, *p.* 93. – *P. simplex* on barley in Belgium, *p.* 90.

Pyretrhum flowers used in preparation of insecticide powders, 820.

Pyridine in the manufacture of insecticide, 820.

Pythium de Baryanum on beetroots in Belgium, *p.* 91.

« QUEIMA do cafeeiro » caused by *Glomerella coffeicola*, 647.

" RAIN-TREE Mealy Bug » (*Phenacoccus iceryoides*) 130.

Ramularia Betae, on beetroot in Belgium, *p.* 91.

Red boll-worm (*Diparopsis castanea*): on cotton in Nyasaland, 1016.

" Requeimado " of coffee (*Sphaerostilbe flavida*), 647.

Retithrips aegyptiaca injurious to vine in Cyrenaica, 136.

Rhizoctonia Solani on cotton in relation to meteorological conditions in Egypt, *p.* 374.

Rice: pests and diseases in Malaya, 47. – *Tylenchus angustus* in relation to meteorological conditions in India, *p.* 375.

Rose: *Macrosiphum* (= *Aphis*) *rosae* and *Myzus* (= *Aphis*) *rosarum* attacked by *Isobremia kiefferi* in Jugoslavia, 374.

Rot: R. of tomatoes (*Phytobacter Lycopersicum*) in Belgium, *p.* 92. – Root rot (*Armillaria mellea*) of apple tree in Belgium, *p.* 93. – Of *Pinus sylvestris* in Belgium, *p.* 95. – Of wood and trunk of apple tree in Belgium, *p.* 93. – Black r. of the vine (*Guignardia Bidwellii*) in relation to meteorological conditions, *p.* 373, *p.* 379. – Brown fruit r., on apple (*Sclerotinia fructigena*) in Belgium, *p.* 93. – Root r., of coffee plant in São Paulo caused by sterile mycelium, 647. – R. of wheat: " the verdissage " method of control for seeds, 236. – Wheat r., (Caries) in Belgium, *p.* 89. – Wehat bunt (*Tilletia Tritici* and *T. levis*) in relation to meteorological conditions in India, *p.* 376. – Wheat r., treated with powdered carbonate of copper, 435. – *Tilletia Tritici* in Roumania, *p.* 341.

Roumania: Pests and diseases of beans, *p.* 690; of peas, *p.* 692. – Phylloxera outbreaks (1884-86), *p.* 37. – Regulations for testing of weeds of forage plants for freedom from weeds and dodder, 890. – *Tilletia Tritici* of wheat, *p.* 341.

Russia: Phylloxera, *p.* 363.

Rust: Blight on plum trees (*Puccinia Pruni-spinosae*) in Belgium, *p.* 92. – Brown r. (*P. triticina*), black r., (*P. graminis*), and yellow r. (*P. glumarum*) on wheat in Belgium, *p.* 89, *p.* 90. – Crown r. (*P. coronifera*) in relation to meteorological conditions in U.S.A., *p.* 379. – Crown r. and black r. on oats in Belgium, *p.* 90. Dwarf r. (*P. simplex*), yellow r., and black r., on barley in Belgium, *p.* 90. – Leaf brown (*Phyllosticta prunicola*) on plum trees in Belgium, *p.* 93. – Needle blight (*Chrysomyxa Abietis*) on spruce firs in Belgium, *p.* 95. – Pear leaf cluster-cup (*Gymnosporangium Sabinae*) in Belgium, *p.* 93. – Pine branch twist (*Melampsora pinitorqua*) on Scots pine in Belgium, *p.* 95. – Pine R. (*Cronartium ribicolum*) destroying Weymonth pines in Belgium, *p.* 95. – *Puccinia dispersa* on rye in Belgium, *p.* 90. – Resistance to stem-rust of Kanred wheat, 831. – Wheat r., inheritance of resistance to *Puccinia graminis*

in crosses between varieties of Durum wheat, 833. – Wheat rusts (*P. glumarum*, *P. triticina*) in relation to meteorological conditions in India, *p.* 370.

Rye: *Urocystis occulta* (Stem smut), *Puccinia dispersa*, *Puccinia glumarum*, *P. graminis*, *Claviceps purpurea* (ergot) in Belgium, *p.* 90.

SALIX CAERULEA: *Bacterium Salicis* in England, 644.

Sawdust mixed with soil causes injury to plants, *p.* 440.

Scab: *Bacillus Savastanoi* (or Bacterial tumour) of olives in Portugal, *p.* 131. – *Spongospora subterranea* of potatoes in Belgium, *p.* 91. – Black sc. of potatoes: legislative measures in Austria, 381. – Inspection for potato scab (*Actinomyces Scabies*) in Michigan, U. S. A., 42. – Experiments in Soil treatment with Sulphur to destroy Sc., *p.* 1061. – Varieties of potato immune from or susceptible to Scab in England, 838. – Varieties resistant to black sc., 520.

Scab: (of fruit): of the apple (*Venturia inaequalis*) in Belgium, *p.* 92; of pear (*Venturia pirina*) in Belgium, *p.* 93; of the tomato (*Cladosporium fulvum*) in Belgium, *p.* 91.

Schizoneura lanigera (Woolly aphis): legislative measures in Belgium, *p.* 98.

Sclerosis of the elm in Belgium, *p.* 94.

Sclerotinia: *S. cinerea* on cherries in Belgium, *p.* 93. – *S. fructigena* on apples in Belgium, *p.* 93. – *S. Fuckeliana* on vines in Belgium, *p.* 94. – *S. sclerotiorum* injurious to beans in Denmark, 124. – *S. sc.* injurious to vegetables in Denmark, *p.* 124.

Sclerotinia sp., *p.* 1131. – *S. Trifoliorum*, *pp.* 1107, 1114, 1131. – *S. T.*, injurious to clover in Belgium, *p.* 92.

Sclerotium: *S. cepivorum*, 371. – *S. monohistum* n. sp., maize parasite in Morocco, 369. – *S. Oryzae*, 371. – *S. Rolfsii*, 371. – *Sclerotium* sp., injurious to Sugar Beet in Morocco, 371.

Scutellista cyanea on *Ceroplastes rusci* in Spain, 129.

"Seed-corn maggot" (*Phorbia fuscipennis*) agent of dissemination of "Potato blackleg" (*Bacillus phytophthorus*) in Minnesota, 643.

Seedling blight of maize and wheat (*Gibberella Saubinetii*) in relation to meteorological conditions in U.S.A., *p.* 377.

Seeds: Cleaning and disinfection of s., in Brazil, 943. – Control of s. in Roumania with reference to dodder and weeds, 890. – Control with reference to weeds, *pp.* 1095, 1163, 1175, 1176. – Control in Latvia with reference to diseases (*Puccinia*, *Ustilago*), 147. – Disinfection of cotton s. with Carbon Disulphide, 302. – Federal Experimental seed-testing Institute, Mont Calme, Lausanne, 435. – Legislation re dodder in Austria, 380. – "Verdissage" of s. against rust and smut, 236.

Septoria Petroselini var. *Apii* on celery in Belgium, *p.* 92.

Short-wave Rays: Beneficial and injurious effects of S-w. r. in nature, *p.* 331.

Smut: see *Ustilago*.

Smut: Covered S. (*Ustilago Hordei*) and naked S. (*U. nuda*) on barley in Belgium, *p.* 90. – Maize S. (*Ustilago Zeae*) in relation to meteorological conditions in India, *p.* 377. – S. of oat (*U. Avenae*) in Belgium, *p.* 90. – S. of oat (*U. Avenae* and *U. levis*): Control by dust treatment, 642. – S. of the onion (*Urocystis Cepulae*) in re-

lation to meteorological conditions in U.S.A., *p.* 378. – S. of Sorghum (*Sphacelotheca Sorghi*) in relation to meteorological conditions in India, *p.* 376. – Stem smut of rye (*Urocystis occulta*, in Belgium, *p.* 90. – Wheat S. (*Ustilago Tritici*) in Belgium, *p.* 89.

Soil: Partial sterilization of s. with antiseptics, *p.* 154, *p.* 743.

Solanum paniculatum attacked by *Phthorimaea operculella*, in Brazil, 377.

Somaliland (Italian): Locusts, *p.* 483, *p.* 484. – Measures for control of plant diseases, 661.

Sonchus: *Aphis* (*Macrosiphum*) *sonchi* attacked by *Isobremia sonchi* in Jugoslavia, 374.

" Sore-shin " disease of cotton (*Rhizoctonia Solani*) in relation to meteorological conditions in Egypt, *p.* 374.

Sorghum: Smut (*Sphacelotheca Sorghi*) in relation to meteorological conditions in India, *p.* 376. – Injurious after-effects of S., *p.* 155.

Spain: *Ceroplastes rusci* and *C. sinensis* found respectively on *Ficus Carica* and on *Myrtus communis* attacked by *Tomocera californica* near Barcellona, 129. – Control of olive fly (*Dacus oleae*) at Cenia, 133. – Diseases of the Olive, discussed at VII International Congress of olive growers, Seville, Dec. 1924, 191. – Measures for protection of insectivorous birds, 394. – Organisation of phytopathological inspection, 389. – Protection of forests against diseases and pests, 651.

Sparrows: natural enemies of locusts in Iraq, *p.* 1183. – Natural enemies of *Tettigonia albifrons* in Bengasi, 648.

" Speckled locust " (*Tettigonia albifrons*) in Bengasi, 648.

Sphacelotheca Sorghi on Sorghum in relation to meteorological conditions in India, *p.* 376.

Sphaerella Fragariae on strawberries in Belgium, *p.* 92. – *S. tabifica* on beets in Belgium, *p.* 91.

Sphaerostilbe flavida on coffee in the State of São Paulo (Brazil), 647.

Sphaerotheca: *S. Humuli* injurious to hops in Belgium, *p.* 92. – *S. Mors-uvae*: legislation re control in Belgium, *p.* 98. – On currant bushes in Belgium, *p.* 94.

Sphex flavipennis, natural enemy of *Tettigonia albifrons*, 648.

Spiny Boll Worm in cotton in Nyaland, 1016.

Spongospora subterranea on potato in Belgium *p.* 91.

Spruce: *Lophodermium macrosporum*, needle disease; *Chrysomyxa Abietis*, needle blight; *Ascochyta piniperda*, leaf blotch; in Belgium, *p.* 95.

Staling of liquid media and growth reactions of certain fungi, 125.

Stauronotus brevicollis, *St. cruciatus* in Hungary, *p.* 473.

Stem smut (*Urocystis occulta*) in Belgium, *p.* 90.

Stephanoderes coffeae, injurious to coffee in Brazil, 1011, 1013.

Stereum purpureum cause of stem disease of plum tree in Belgium, *p.* 93.

Sterilization (partial) of soil by antiseptics, *p.* 154, *p.* 743.

Stictis coffeicola, on coffee in the State of São Paulo, Brazil, 647.

Stilbella flavida on coffee, 647.

Stilbum flavidum on coffee, 647.

Straits Settlements and Federated Malay States: Work of the Department of Agriculture in regard to Mycological and Entomological Services, 184.

Strawberry: Insects and cryptogamic diseases of the S., 472. – *Acalla comariana*, *Anthonomus rubi*, *Mars-*

sonina Potentillae var. *Fragariae* and *Mermis* sp., in Denmark, 124. – *Oidium* in relation to meteorological conditions, *p.* 374. – Leaf-blight (*Sphaerella Fragariae*) in Belgium, *p.* 92.

Strawberry leaf-blight (*Sphaerella Fragariae*), in Belgium, *p.* 92.

Sugar Beet: *Sclerotium* sp., in Morocco, 371.

Sugar cane: *Brassolis istmia* in Costa Rica, 134. – "Uba" cane and resistance to disease, especially to "mosaic", 898. – "Uba" in Jamaica, 246. – Endowment for studies re "Mosaic" of S. c. in Cuba, 678. – Diseases of S. c., 368. – Diseases and insect pests of S. C., in Cuba, 904. – "Mealy bug" (*Pseudococcus calceolariae*) in Louisiana, U. S.A., 903. – "Moth borer" in Louisiana, 903.

Sulphur: Fungicidal properties, 820. – Experiments with S. in Soil treatment for control of Potato Wart disease, *p.* 1061.

Switzerland: Chestnut: *Liparis dispar* (= *Lymantria dispar*), 139. – Federal Experimental Seed-testing Institute, Mont Calme, Lausanne (anticrytogamic experiments), 435. – *Pinus Cembra* attacked by *Lophyrus similis*, 378. – Work of Experimental Institute for fruit and vine-grow-ing and horticulture, Wädenswil, and of Federal Station of Viticultural experiments, Lausanne and Pully, 433, 434.

Synchytrium endobioticum (Wart disease of potatoes): Experiments on control of *S. e.*, with Sulphur soil treatment, *p.* 1061. – Legislation in Belgium for prevention of spread of *S. e.*, *p.* 98. – Varieties of potatoes immune or susceptible to *S. e.*, in England, 838.

Synopeas rahnis, parasite of *Isobremia kiefferi*, in Jugoslavia, 374.

Tachinid from Cuba, introduced into Louisiana, as natural enemy of moth borer on sugar cane, 903.

"Take-all" of wheat (*Ophiobolus graminis*, *Leptosphaeria culmifraga*), in Belgium, *p.* 89.

Tamarix, attacked by *Lecanium persicae*, at Andover (Hants) England, 649.

Taphrina: *T. deformans* on peach in Belgium, *p.* 93. – *T. Insititiae* on plum in Belgium, *p.* 93. – *T. Pruni* on plum in Belgium, *p.* 93.

Tea: Diseases, 368.

Termites: various treatments for protecting wood from T., 820.

Tetrachloride (carbon) as an insecticide, 820.

Tettigonia albifrons (Speckled locust) in Bengasi, 648.

Thaumetopoea wilkinsoni injurious to pines in Isle of Cyprus, 379.

Thrips sp., on *Dianthus* in Denmark, 124.

Tilletia: *T. Caries* on barley in Denmark, 124. – *T. Tritici*, prevalent in Roumania, *p.* 341. – *T. Tritici* and *T. levis*, on wheat in India, *p.* 376.

Tinnunculus neumanni, and *T. vespertinus*, natural enemies of *Tettigonia albifrons* in Bengasi (Cyrenaica), 648.

Tipulidae larvae in soils, *p.* 1075.

Tobacco: Diseases, 368. – *Fusarium oxysporum* in relation to meteorological conditions in U.S.A., *p.* 378. – T. mildew (*Erysiphe Cichoriacearum*) in relation to meteorological conditions in India, *p.* 374. – "Mosaic" in Belgium, *p.* 92. – "Potato moth" (*Phthorimaea operculella*) found on T. in Brazil, 377.

Tobacco Wilt (caused by *Fusarium oxysporum* var. *Nicotianae*) in relation to meteorological conditions in U.S.A., *p.* 378.

Tomato: Bacterial disease (*Phyto-

bacter Lycopersicum), leaf rust (*Cladosporium fulvum*) in Belgium, *p.* 92. – *Cladosporium fulvum* in Denmark, 124. – Diseases, 368. – *Fusarium Lycopersici* in relation to meteorological conditions in U.S.A., *p.* 378. – *Phytophthora infestans* in Denmark, 124. – *Verticillium albo-atrum* in Denmark, 124.

Tomato Wilt (caused by *Fusarium Lycopersici*) in relation to meteorological conditions in U.S.A., *p.* 378.

Tomocera californica, hymenopteron parasitic on Coccidae *Ceroplastes rusci* and *C. sinensis*, in Spain, 129.

Trametes Pini unknown in Belgium, *p.* 95.

Trees: Fruit trees: Legislative measures against caterpillars, in Austria, 381. – Diseases in Belgium, *p.* 92, *p.* 93. – *Xylotherus dispar* in Denmark, 124. – Forest and Ornamental trees: diseases observed in Belgium, *p.* 94.

Trioza viridula on carrots in Denmark, 124.

Tripoli: Locusts (control), *p.* 1189.

Tropical Plant Research Foundation, (Washington D. C., U.S.A.): investigations re diseases and insects of tr. p., 904.

Turkey: Control of the Olive Fly (*Dacus oleae*) *p.* 484, *p.* 485.

Turnips: Diseases observed in Belgium, *p.* 92.

Tylenchus angustus (nematode worm) on rice in relation to meteorological conditions in India, *p.* 375.

Typhula Trifolii, *p.* 1107, *p.* 1114.

« UBA » (Sugar cane): its resistance to disease, especially "mosaic", 898. – Immune from "mosaic" in Jamaica, 246.

Uncinula necator on vines in Belgium, *p.* 94.

United States: Cucumber: "mosaic" in relation to meteorological conditions, *p.* 379. – *Erysiphe graminis* in relation to meteorological conditions, *p.* 379. – *Fusarium conglutinans* in relation to meteorological conditions, *p.* 378. – *Fusarium oxysporum* and *F. radicicola* in relation to meteorological conditions, *p.* 378. – *Fus. Lini* on flax in relation to meteorological conditions, *p.* 378. – *Fus. oxysporum* var. *Nicotianae* on tobacco in relation to meteorological conditions, *p.* 378. – *Gibberella Saubinetii* (seedling blight of maize and wheat) in relation to meteorological conditions, *p.* 377. – Improvement methods in Michigan and New-York States, 42. – Maize: *Cephalosporium Acremonium*, 126. – Methods for Seed Potato improvement, 42. – Oat rust (*Puccinia coronifera*) in relation to meteorological conditions, *p.* 379. – Onions: *Urocystis Cepulae* in relation to meteorological conditions, *p.* 378. – Potato: *Bacillus phytophthorus* agent for spread of "blackleg" in Minnesota, 643. – Sugar Canes in Louisiana attacked by moth borers, 903. – Tomato: *Fusarium Lycopersici* in relation to meteorological conditions, *p.* 378. – *Verticillium albo-atrum* in relation to meteorological conditions, *p.* 378. – Wheat: *Puccinia graminis* in relation to meteorological conditions, *p.* 379.

"Upsulun", fungicide tested by Swiss Federal Experimental Seed-testing Institute, Lausanne, 435.

Urocystis Cepulae on onions, in relation to meteorological conditions in U.S.A., *p.* 378. – *U. occulta*, on barley in Denmark, 124. – On rye in Belgium, *p.* 90.

Uromyces: *U. Betae* on beetroot

in Belgium, *p.* 91. – *U. Phaseoli*, injurious to beans in Roumania, *p.* 690. – *U. Pisi*, on peas in Roumania, *p.* 692.

Uruguay: *Chionaspis citri* (= *Howardia citri*), 137.

Ustilago: *U. Avenae*, on oats in Belgium, *p.* 88. – *U. A.*, and *U. Hordei* on barley in Denmark, 124. – *U. A.*, and *U. levis*, dust treatment, 642. – *U. Crameri*, *p.* 1131. – *Ustilago* and seeds in Latvia, 147 – *U. Hordei* and *U. nuda*, in barley in Belgium, *p.* 90. – *U. Tritici* on wheat in Belgium, *p.* 89. – *U. Zeae* on maize, in relation to meteorological conditions in India, *p.* 377.

VEGETABLES: *Ascochyta Pisi*, *Botrytis*, *Fusarium* spp., *Macrosiphum pisi*, *Sclerotinia sclerotiorum*, in Denmark, 124. – Veg. attacked by *Tettigonia albifrons* in Bengasi, 648.

"Venetan", nicotine soap insecticide tested in Denmark, 124.

Venturia inaequalis and *V. pirina* respectively injurious to apples and pears in Belgium, *p.* 92, *p.* 93.

Vermicularia Capsici on pepper plants in India in relation to meteorological conditions, *p.* 371.

Verticillium albo-atrum, on the potato in relation to meteorological conditions in U.S.A., *p.* 378. – On the potato in Belgium, *p.* 91. – On the tomato in Denmark, 124.

Vine: Black rot of the v. (*Guignardia Bidwellii*) in relation to meteorological conditions, *p.* 373, *p.* 379. – *Franklinothrips myrmicaeformis* in Cyrenaica, 136. – *Heterodera radicicola*, 135. – Injurious insects, 135. – Grape mildew (*Plasmopara viticola*), grey mould (*Sclerotinia Fuckeliana*), powdery mildew (*Uncinula necator*) in Belgium, *p.* 94. – *Oidium* in relation to meteorological conditions, *p.* 374. – Peronosporaceae (*Plasmopara viticola*) in relation to meteorological conditions, *p.* 372, *p.* 372, *p.* 379. – Phylloxera in Italy, 973; in Roumania (1884-86) *p.* 37; in Russia, *p.* 363. – *Tettigonia albifrons* in Bengasi, 648.

Volutella ciliata on *Aspidistra* in Denmark, 124.

WALNUT TREE: attacked by *Gnomonia leptostyla* and various Polyporaceae, *p.* 94.

Watermark disease of Cricket-bat Willow (*Bacterium Salicis*), 644.

Weeds: Investigation re W. seeds found among seeds of Argentina, with reference to their origin and distribution in the producing districts of Argentina, *p.* 1163. – Legislative measures in Austria, 381. – W. control, *p.* 746. – Weeds and seed testing, *p.* 1173, *p.* 1177. – W., and seed testing of forage plants in Roumania, 890. – W. seeds as a means determining the source of seeds, *p.* 1136. – Weed seeds and seeds of red clover and lucerne, *p.* 1095.

Weevil of the Olive (*Prays oleaellus*) in Portugal, 131.

Wheat: *Agriotes lineatus* and *Hylemyia coarctata* in Denmark, 124. – Black rust (*Puccinia graminis*) in Belgium, *p.* 89. – Brown rust (*Puccinia triticina*) on W., in Belgium, *p.* 89. – Caries of w., in Belgium, *p.* 89; *Tilletia Tritici* prevalent in Roumania, *p.* 341. – *Erysiphe graminis* in relation to meteorological conditions in Italy, *p.* 373. – Experiments with powdered carbonate of copper to check rot, 435. – Inheritance of resistance to *Puccinia graminis* in

crosses between varieties of Durum W., 833. – Kanred W., and its stem-rust resistance, 831. – *Puccinia glumarum* and *P. triticina* in relation to meteorological conditions in India, *p.* 370. – *Puccinia graminis* in relation to meteorological conditions in U. S. A., *p.* 379. – Seedling blight (*Gibberella Saubinetii*) in relation to meteorological conditions in U.S.A., *p.* 377. – Smut (*Ustilago Tritici*) in Belgium, p. 89. – « Takeall » caused by *Ophiobolus graminis* and *Leptopsphaeria* in Belgium, *p.* 89. – *Tilletia Tritici* and *T. levis* in relation to meteorological conditions in India, *p.* 376. – " Verdissage " of seeds as a method of protection from rust and smut, 236. – Yellow rust (*P. glumarum*) in Belgium, *p.* 89. – W., in Bengasi attacked by *Tettigonia albifrons*, 648.

" White-red " disease of citrus fruits, (control of) ,722.

Wilt: Potato W., inspection in U.S.A., 42. – Tobacco w. (*Fusarium oxysporum*, var. *Nicotianae*) in relation to meteorological conditions in U.S.A., *p.* 378. – Tomato w. (*Fusarium Lycopersici*) in relation to meteorological conditions, *p.* 378. – W. of cotton in Peru, 56.

Witch's broom disease of plum tree, *Taphrina Insititiae* in Belgium, *p.* 93.

Württemberg: apple mildew in relation to meteorological conditions, *p.* 373.

XYLOTHERUS DISPAR: on fruit trees in Denmark, 124.

ZEA MAYS INDENTATA, *Z. mays indurata* and *Z. mays saccharata*: caused by *Cephalosporium Acremonium*, in U. S. A., 126.

B) INDEX OF AUTHORS

ANDERSON J. P., 531.
Anderson T., *p.* 1173.
Averna-Saccà R., 647.

BADOUX, H., 139.
Barbey A., 378.
Barbier, A. M., 371.
Barthel Chr., *p.* 435.
Bemis, K., 42.
Bondar, G., 377.
Boyle, C., 125.
Brezeale, J. F., *p.* 155.
Brierley, W. B., *p.* 1061.
Bussard, L., *p.* 1174.
Butler, E. J., *p.* 369.

CARTON, P., 316.
Cavara, F., 372.
Cecconi, G., 138.
Chevalier, Aug., *p.* 663.
Chiritescu-Arva, M., *pp.* 680-693.
Clark, J. A. and Martin, J. H., 831.
Crowther, E. M., *p.* 1061.

DAY, W. R., 644.
Dean, G. A., 535.
Degen, A. von. *p.* 1175.
De Azevedo Marques Luiz, A., 375.
De Seabra A. F., 131, 132.
Dickerson J. R., 821.
Dufrénoy F. and Gaudineau M., 373.

FERREIRA E., 302.
François, L., *p.* 1134.

GARCIA MERCET, R., 129.
Gaudineau, M., 373.
Gentner, G., *p.* 1095.
Glymne M. D., *p.* 1061.
Gram, E. and Rostrup, S., 124.
Green, E., 649.
Guillaume, M., 314.

HARDY, F., 108.
Harrinton, J. B., 833.
Hawkins, R. S. 827.
Holbert J., 126.

JABLONOWSKI, J., *p.* 468.
Jack, H. W., 47.
Johnson, O. M., 819.

KINCH E. A., *p.* 1182.
Kinzel, W., *p.* 331.

LA FORGE, F. G., 107.
Leach, J. G., 643.
Leiningen W. Count, *p.* 155.
Little, A., 86.
Lüstner, G., 128.

MACDONNELL, C. C., 820.
Maines, G. H. and La Forge, F. B., 107.
Malloch, J. R., 130.
Marchal, E., 368.
Marchal, Em., *p.* 88.
Maresquelle, 369.
Markoff, L., *p.* 357.
Martin, J. H., 831.
Mathews, A. *p.* 743.
Matthews, A., *p.* 154.
Morris, H. M., *p.* 1075.
Munteanu, A., *p.* 388.

PETERY, W. von *p.* 1163.

Picado, C., 370.
Perry, F. R., 42.

RAMAKRISHNAN, T. S., 646.
Ramsbottom, J. K., 551.
Reddy, C. S. and Holbert, J. T., 126.
Roach, W. A., Glynne M. D., Brierley, W. B. and Crowther, E. M., *p.* 1061.
Rostrup, S., 124.

SHAW, F. J. F., 645.
Soederbaum H. G. and Barthel Chr., *p.* 440.

Sundararaman, S. and Ramakrishnan, T. S., 646.

TAMS, W. H. T., 376, 379.
Teodorescu J. C., *p.* 35.
Theron, J. J. and Hall, T. D., 86.
Thomas Roy, C., 642.
Trotter, A., 127.
Trujillo Peluffo, A., 137.

VIVARELLI, L., 135.
Voukassovitch, P., 374.

ZANON, V., 136, 648.

Errata graviora et addenda.

(*International Review of the Science and Practice of Agriculture*, New Series, Vol. III, 1925).

Page 142, lines 32-34, read as follows the title of the abstract: *Investigations of soil rocks and their stratification in the Speier chart and on soils of the Kusel chart of the Bavarian Geological Map* 1 : 100 000.

" 595, lines 6 and 7, substitute the following quotation : BONDAR G., *Phtorimaea operculella* Zell. no Brasil. *Correio agricola*, Year II, No. 10, Pp. 292-294. Bahia, 1924.

" 595, line 29, instead of BARTHEL C. read BARBEY A.

" 838, line 38, instead of *milk and work* read *meat and work*.

" 898, lines 8 and 15, instead of *Southern Italy and the Insular Possessions* read *Southern Italy and the Italian Islands*.

" 913, line 13, instead of *Canada* read *Japan*.
line 14, instead of *Canadian* read *Japanese*.

" 954, explanation of fig. 194, instead of D = *density* read D = *curve of the mixture*; instead of K = *density* read K = *concentration*.

" 1022, line 4 of the table, 3rd column, instead of 11,18 read 18,18.

" 1058, line 27, suppress the word *Laon*.

" 1060, line 16, instead of *Jonboden*, read *Tonboden*.

" 1060 : after line 16 add : COMBER N. M. The Role of the Electronegative Ions in the Reactions between Soils and Electrolytes. — *Trans. Faraday Society*, XX, *p*. 567, 1925.

" 1070 : after line 41 transfer and insert lines 45-48 of page 1071 and lines 1-19 of page 1072.

Plates LXXXIV (opposite to page 973) and LXXXV (opposite to page 974) : exchange the explanations of the figures 233 and 236.

INDIAN AGRICULTURAL RESEARCH
INSTITUTE LIBRARY
NEW DELHI.

Date of issue	Date of issue	Date of issue
....	....	....
....	....	....
....	....	....
....	....	....
....	....	....
....	....	....
....	....	....
....	....	....
....	....	....
....	....	....
....	....	....
....	....	....